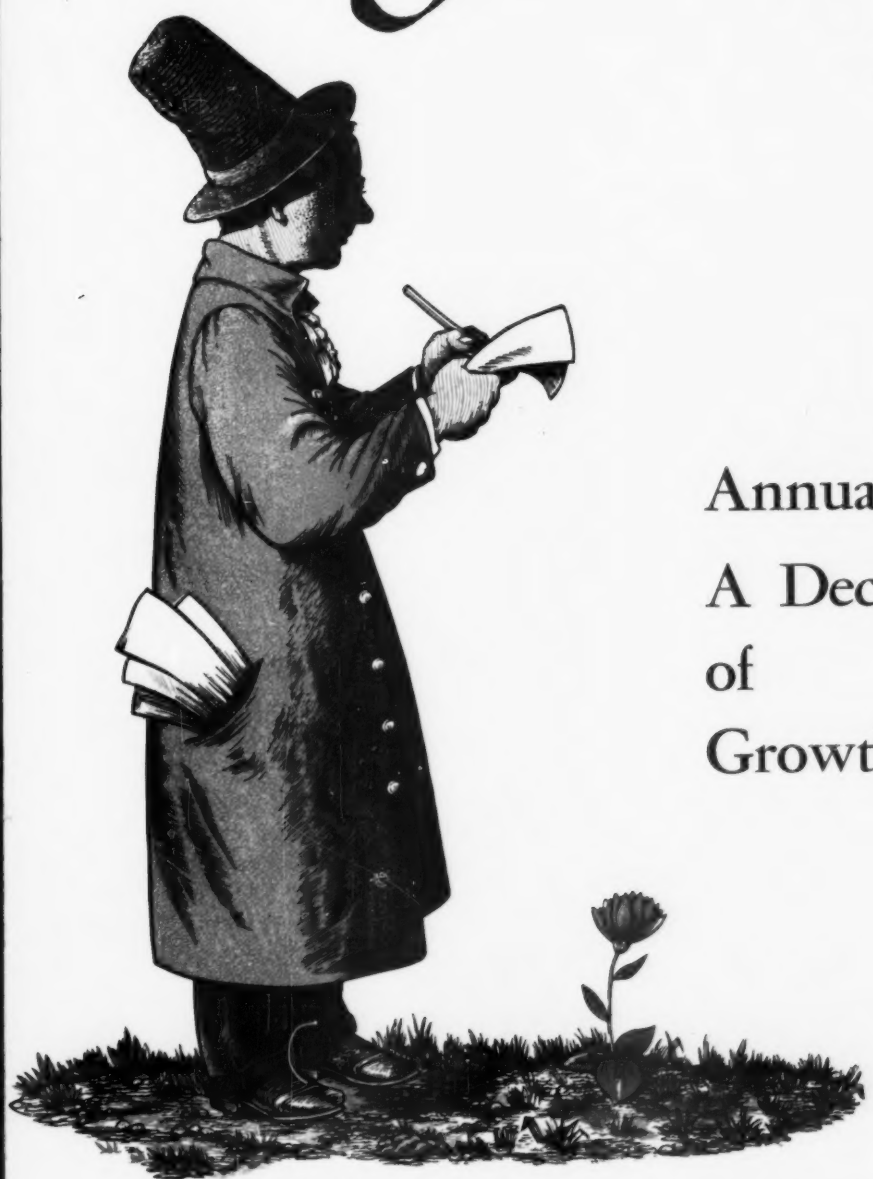
Consulting Engineer

JANUARY 1961



Annual Survey . . .
A Decade of Growth

SILENCE IS THE SOUND OF QUALITY

. . . In the NEW ADVANCE Sound Conditioned 40-Watt Two-Lamp Rapid Start Fluorescent Lamp Ballasts

A SOUND RATED

Now, through continuing research and development, Advance engineers bring to the lighting industry these new **"A"** QUIET-RATED fluorescent lamp ballasts that absorb the magnetic vibration of the core and coil before it becomes sound. This is a new concept that is only presently possible to achieve with the use of a special THERMO-PLIABLE COMPOUND. These new ballasts also incorporate the exclusive Advance "KOOL-KOIL" principle. They operate cooler, give up to 15% more light output and increase ballast life 3½ to 4 times over ordinary ballasts.

For silent lighting installations in schools, hospitals, libraries and other critical areas where absence of noise is the primary consideration, specify ADVANCE **"A"** QUIET-RATED fluorescent lamp ballasts. Catalog No. RQM-2S40 for 118 V. operation. Catalog No. VQM-2S40 for 277 V. operation.

"The Heart of the Lighting Industry"

Mfg. in Canada by: Advance Transformer Co., Ltd. 5780 Pare St., Montreal, Quebec.

ADVANCE TRANSFORMER CO.

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Here are the steam traps designed especially for heating systems . . .

ARMSTRONG OPEN FLOAT AND THERMOSTATIC STEAM TRAPS

Engineered for low pressure intermittent service where large amounts of air accumulate while steam is off

Armstrong O.F.&T. Traps make it possible for heating systems to deliver the efficiency they were designed to deliver. They are ideal for low pressure unit heaters, preheat and reheat coils, converters, hot water generators, etc.

Advantages to the user:

BIG AIR HANDLING CAPACITY—Thermic vent handles large amounts of air in system when steam is turned on. Fixed vent handles normal air in system.

NO STEAM LOSS—Stainless steel valve is water sealed, is not damaged by dirt or scale, cannot develop steam leaks.

CONDENSATE AND AIR REMOVED AT STEAM TEMPERATURE—No opening lag.

LONG LIFE—All working parts, including open float, are stainless steel. Bodies and caps designed for 250 psig operation. Open float cannot collapse.

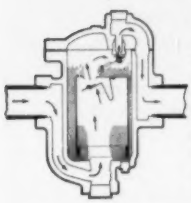
MINIMUM MAINTENANCE—Simple, proved design and high quality materials assure trouble-free service.

LOW COST—Mass production methods permit high quality at low cost.

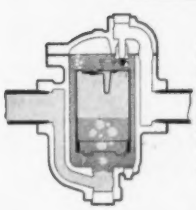
EASY INSTALLATION—Horizontal straight-through pipe connections, conventional sizes.

UNCONDITIONALLY GUARANTEED—All Armstrong Traps are guaranteed to satisfy the user or purchase price will be refunded.

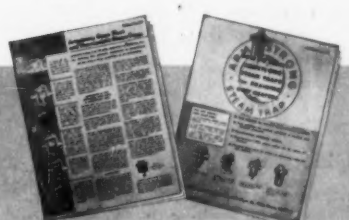
HOW ARMSTRONG O. F. & T. TRAPS WORK:



When steam is turned on, it pushes air through the wide open thermic vent and trap discharge valve at full differential pressure between supply and return lines. Condensate formed by incoming steam goes right through.



As steam reaches open float, thermostatic vent closes. Float fills with steam and rises to close trap valve. Residual air and CO_2 escape through fixed vent at steam temperature.



BULLETIN NO. 775 BULLETIN NO. 801

Use the coupon at right to get these helpful bulletins: No. 775 describes O.F.&T. traps fully. No. 801 tells how to select traps for draining unit heaters including data on 30 makes of unit heaters.

ARMSTRONG MACHINE WORKS
9656 Maple St. • Three Rivers, Mich.

Armstrong Machine Works
9656 Maple St., Three Rivers, Mich.

Please send me: ☐ O.F.&T. Trap Bulletin No. 775; ☐ Unit Heater Bulletin No. 801.

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Address.....

City.....Zone.....State.....

Consulting Engineer®

For Engineers in Private Practice

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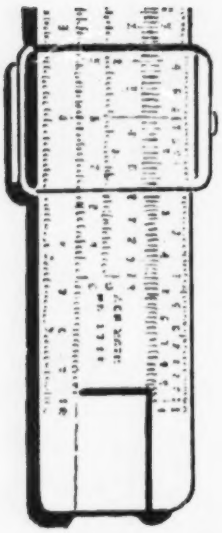

Now, bring in fresh air or remove foul air with harmonizing

PENNHOUSE

ROOF VENTILATORS

ENGINEERED BY ROOF FAN EXPERTS
WHO OFFER THE FIRST, COMPLETE
TECHNICAL BULLETIN ON HOW
TO SIZE AND SELECT
PENNHOUSE VENTILATORS

NEW FROM PENN: ENGINEERING DATA THAT ADDS TO YOUR WORKING TOOLS!

The newest way to harmonize roof fan installations is with Penn Ventilator PENNHOUSES. Laboratory-engineered and architecturally functional, Pennhouses are most often used as gravity ventilators, pressure relief ventilators, fan discharge caps, fresh air intakes, and sight shields (for aesthetic purposes) for roof mounted equipment.

In designing the Pennhouse, Penn has utilized every imaginative quality feature that only a roof fan expert can provide . . . capacity and pressure tests in an approved laboratory, easy access louvred sections, and 12 gauge extruded aluminum for its unmatched durability and sleek appearance.

Important for every engineer to have on hand is the new Pennhouse Technical Bulletin BSO-60 which now offers valuable engineering data, and for the first time, the most complete sizing chart that simplifies selecting the proper size unit for any given area. Get all the facts today on how the Pennhouse can serve your roof ventilation requirements. Write direct . . . or contact your local Penn representative.

PENN VENTILATOR CO., Inc.
PHILADELPHIA 40, PENNA.

A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

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One of many direct factory representatives at your service:

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How Imaginative Engineering Provided Air Conditioning To Fit A School Budget

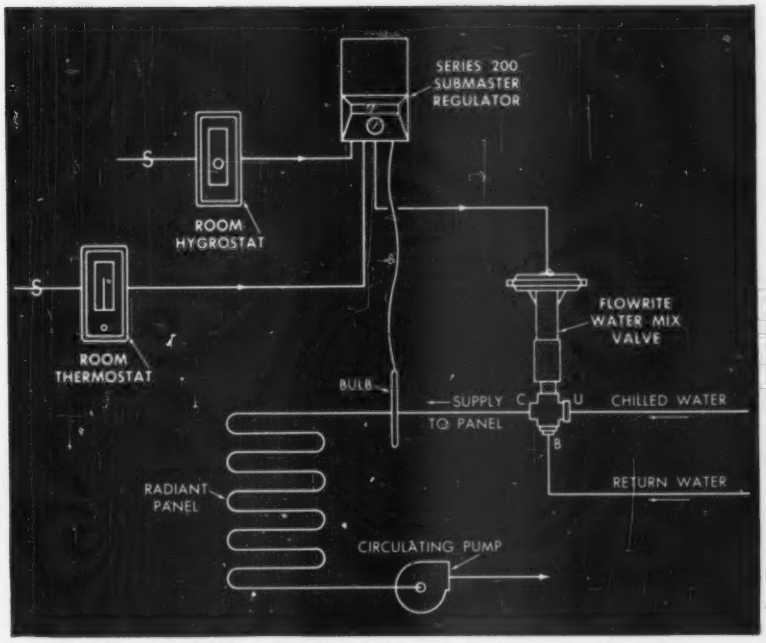
Must school air conditioning always be "too expensive"? Perkins & Will, Chicago architects and engineers, didn't think so last year when they designed suburban Homewood-Flossmoor High School. Without exceeding the school budget, they provided an air conditioned area large enough for complete summer sessions, including 15 classrooms, the library and all administrative offices. Actually, cooling for 25,000 square feet added less than 3½% to normal building cost — less than $4 per square foot of cooled area.

Homewood-Flossmoor High School, Flossmoor, Illinois. Air conditioned section (center) connects to other school facilities by glass-enclosed passageways.
Architects and Engineers: PERKINS & WILL, CHICAGO
Mechanical Contractor: THE ECONOMY PLUMBING AND HEATING CO. OF CHICAGO.

Perkins & Will team of architects and engineers works out details of the cooling system design features and controls for the Homewood-Flossmoor school. From left to right are F. Philip Brotherton, Designer and Project Architect; Rudolph J. Houkal, Chief Mechanical Engineer, and Edward C. Colin, Chief Structural Engineer.

How it was done

Perkins & Will grouped all rooms where both heating and cooling were desired into one section of the school. An interesting design feature is the core of 15 classrooms, surrounded on all sides by other rooms. The fuel savings realized from this "insulated" core help defray the added expense of cooling the entire summer school section. The engineers concentrated all mechanical service equipment beneath this section to eliminate long air conditioning channels. Double ducts and automatic controls were carefully designed for easy switchover to cooling and to take full advantage of tempered return air and outside air during spring and fall seasons.



Ceiling Panel Condensation Control

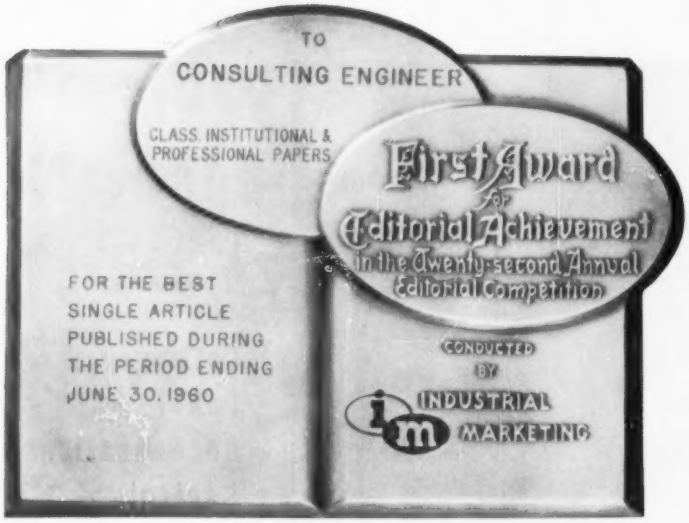
To back up the mechanical efficiency it so carefully designed into the heating, cooling and ventilating system, the Perkins & Will firm specified a Powers system of pneumatic temperature control, including the important dew point control which acts on the chilled water auxiliary cooling used in rooms exposed to the outside. This control (see diagram) utilizes a Powers Water Mix Valve on the ceiling panel chilled water supply and a low limit Submaster Regulator. The Powers Hygrostat measures room humidity conditions and resets the low limit temperature to prevent condensation on panel surfaces, yet allows supply water temperature to be as low as possible for maximum cooling.

Fuel savings in all zones, including those not cooled, are maintained with Powers Day-Night zone controls. A 7-day program clock on the master control panel in the boiler room provides easy switching from day cycle to night cycle. This Powers pneumatic control panel automatically provides a 24-hour-a-day picture of temperature levels in all zones.

Write for the latest Powers Catalog of efficient, economical pneumatic controls for schools and other structures.

Homewood-Flossmoor Maintenance Superintendent William C. Drews (left), takes readings from the automatic Powers pneumatic control panel.

THE POWERS REGULATOR COMPANY
DEPT. 161, SKOKIE 53, ILLINOIS
Offices in Principal Cities in U.S.A. and Canada
MANUFACTURERS OF THERMOSTATIC CONTROLS SINCE 1891



The Readers' Reward

EARLY LAST MONTH our editors accepted two awards for editorial excellence. One was for the best single article (Report on Dome Structures, December 1959); the other, for best original research.

The annual *Industrial Marketing* awards are a competition among leading publications, and we are naturally pleased. But our editor pointed out that he was accepting the CONSULTING ENGINEER awards not for himself, nor even for his staff. He was accepting for our readers.

This was more than the customary modesty of the magnanimous winner. These awards were rightfully the readers', particularly the winning research articles "Survey of the Profession" (January 1959, January 1960).

These annual survey articles are presentations of data supplied by the readers of CONSULTING ENGINEER. Our editors simply put the figures together, calculate averages, prepare charts, and inject an occasional interpretation.

The real work is done by our readers, and the effort involved is astounding. Before mailing the questionnaires, the editors test them on a dozen typical firms. They find it takes an hour, on the average, for the owner, partner, or principal to fill in the questionnaire. This year we got back 2315 completed forms. Assigning a purely norminal rate of $10 per hour for the time involved, this means that the profession has contributed over $23,000 to the current survey.

Without fail, read your 1961 survey "A Decade of Growth" beginning on page 110. We are even prouder of this article than of the award winners of the last two years.

But we are proudest of our readers, who are our unpaid but thoroughly appreciated research staff.

Rw Roe

Managing Director

New from American-Standard
Industrial Division

Air-Lift† for modern hospitals

Air-Lift is a new concept of coordinated products and services from American-Standard Industrial Division. Its purpose is to help you lift the efficiency of today's specialized buildings through better control of indoor climate. Air-Lift offers you one-source responsibility for quality and performance in air-conditioning, heating, and ventilating equipment that is designed, engineered, and manufactured to work together.

To see how Air-Lift can benefit your building . . .

← LIFT THE FLAP

†Service-mark of American-Standard

American-Standard Industrial Division

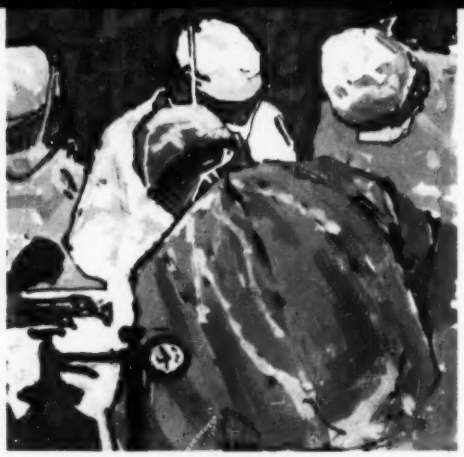
AIR-LIFT IN ACTION

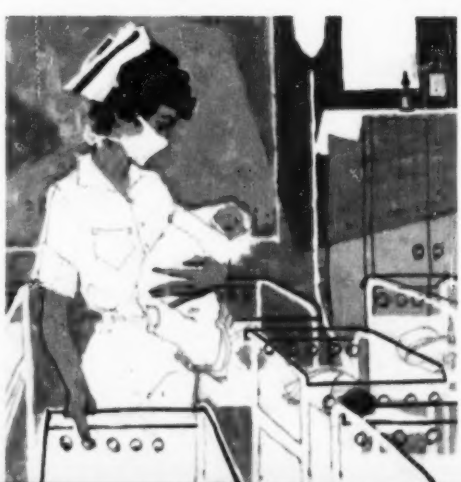
Air conditioning . . . the unseen member of the hospital staff

As today's hospitals are designed, air-conditioning systems must serve many functions . . . each of them vital, in the truest sense of the word.

Precise control of temperature, humidity, air movement and air cleanliness in operating rooms, laboratories, and nurseries . . . year-round supply of process steam for sterilization and for laundries . . . all demand a closely integrated system. It is here that the American-Standard Industrial Division Air-Lift goes into action.

With long experience in providing heating, cooling, refrigeration, ventilating, and air-handling components for *complete* air-conditioning systems in specialized buildings of every description . . . American-Standard Industrial Division can offer valuable assistance with equipment selection and on-the-job problems to assure a smooth-functioning system that will lift the efficiency of your building to new highs.





THOROUGH...

Multiple changes of air—with little or no recirculation—are recommended to clear operating rooms of pathogenic bacteria carried by occupants. Further, air-handling equipment must maintain a positive pressure within the room to prevent entry of air from unsterile areas.

FAST...

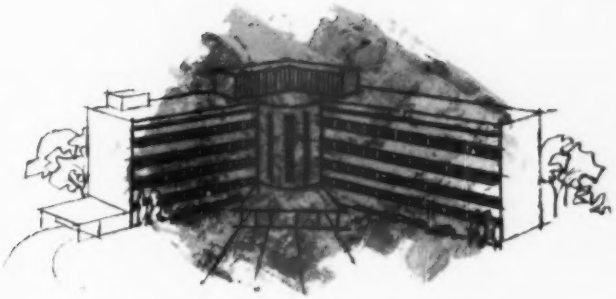
Delicate balance of air supply and exhaust is imperative in infectious disease laboratories. A constant supply of fresh air, sometimes under strict humidity control, is needed to protect personnel—yet air velocity and pressure must be kept low to minimize movement of contaminated air.

VERSATILE...

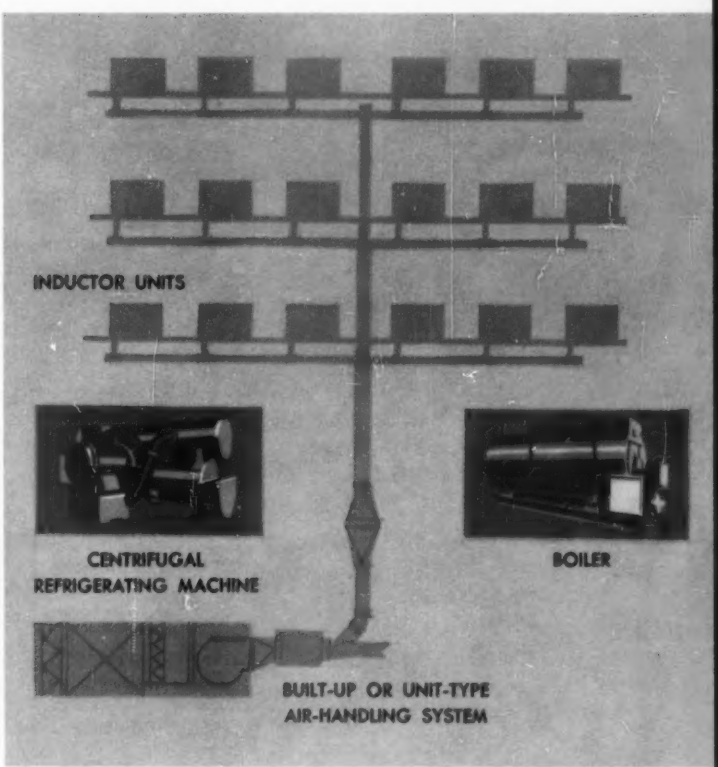
Wall units in patients' rooms heat and cool quietly, even compensate for sun and shadow. Room temperature and humidity may be individually controlled . . . but the central system conditions the air.

DEPENDABLE EQUIPMENT...

Special units provide ventilation air, maintain constant temperature and relative humidity in nurseries and throughout maternity sections.



...ALL from American-Standard Industrial Division



One-source responsibility

The heart of American-Standard Industrial Division's Air-Lift Service

Now . . . with the combined American Blower, Ross Heat Exchanger, and Kewanee Boiler product lines . . . American-Standard* Industrial Division offers *all* the major components for complete, integrated air-conditioning systems.

You benefit by getting heating, cooling, refrigerating, and ventilating equipment designed, engineered, and manufactured to work together. And—most important—you have one-source responsibility for its quality and performance.

Offices in all principal cities are staffed by product specialists whose practical knowledge of the selection and application of air-conditioning equipment may prove most helpful to you. May we serve you? AMERICAN-STANDARD INDUSTRIAL DIVISION, DETROIT 32, MICHIGAN. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO. EXPORT DIVISION, AMERICAN-STANDARD, NEW YORK CITY.

Products designed, engineered, and manufactured to work together

AIR CONDITIONING

Centrifugal Refrigerating Machines • Central-Station Air Conditioners • Package Water Chillers Room Fancoil Units • Induction Units • Multi-Zone Air Conditioners • Sprayed Coil Dehumidifiers • Air Washers • Cooling Coils • Self-Contained Air Conditioners • Cooling Towers • High-Pressure Fans

HEATING

Firebox, Scotch-Type, and Package Boilers Steam, Hot-Water, and Gas-Fired Unit Heaters Heating and Ventilating Units • Heating Coils Cabinet Heaters • Industrial Heaters

VENTILATION

Centrifugal Fans • Propeller Fans • Axial Fans Power Roof Ventilators • Utility Sets • Specialized Fans and Blowers

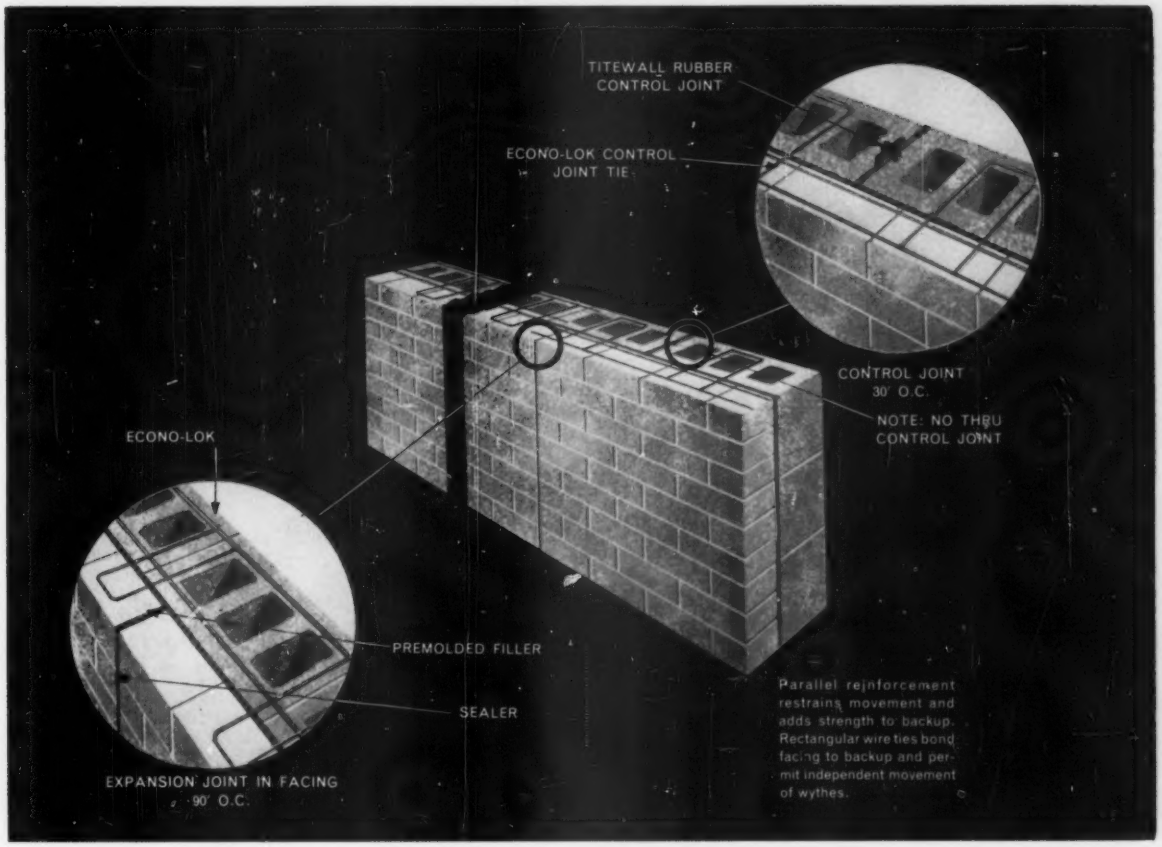
SERVICE-WATER HEATING AND FLOW CONTROL

Instantaneous Water Heaters for service-water, booster, or convertor duty • *Gyrol*® Fluid Drives to drive water-service pumps—eliminate compressed-air system or roof tank

AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

NO BRICK HEADERS!
NO THRU WALL EXPANSION JOINTS . . .
WITH ECONO-LOK®*



Exposed sides and interior sides of faced masonry walls are subject to differing stresses under varying atmospheric conditions.

These stresses continue throughout the life of the building and will—if not relieved—eventually cause fatigue failure.

These normal stresses can be virtually eliminated through the use of ECONO-LOK®* reinforcing ties and the proper spacing of control or expansion joints. WRITE FOR NEW TECHNICAL CATALOG.

AA WIRE PRODUCTS COMPANY

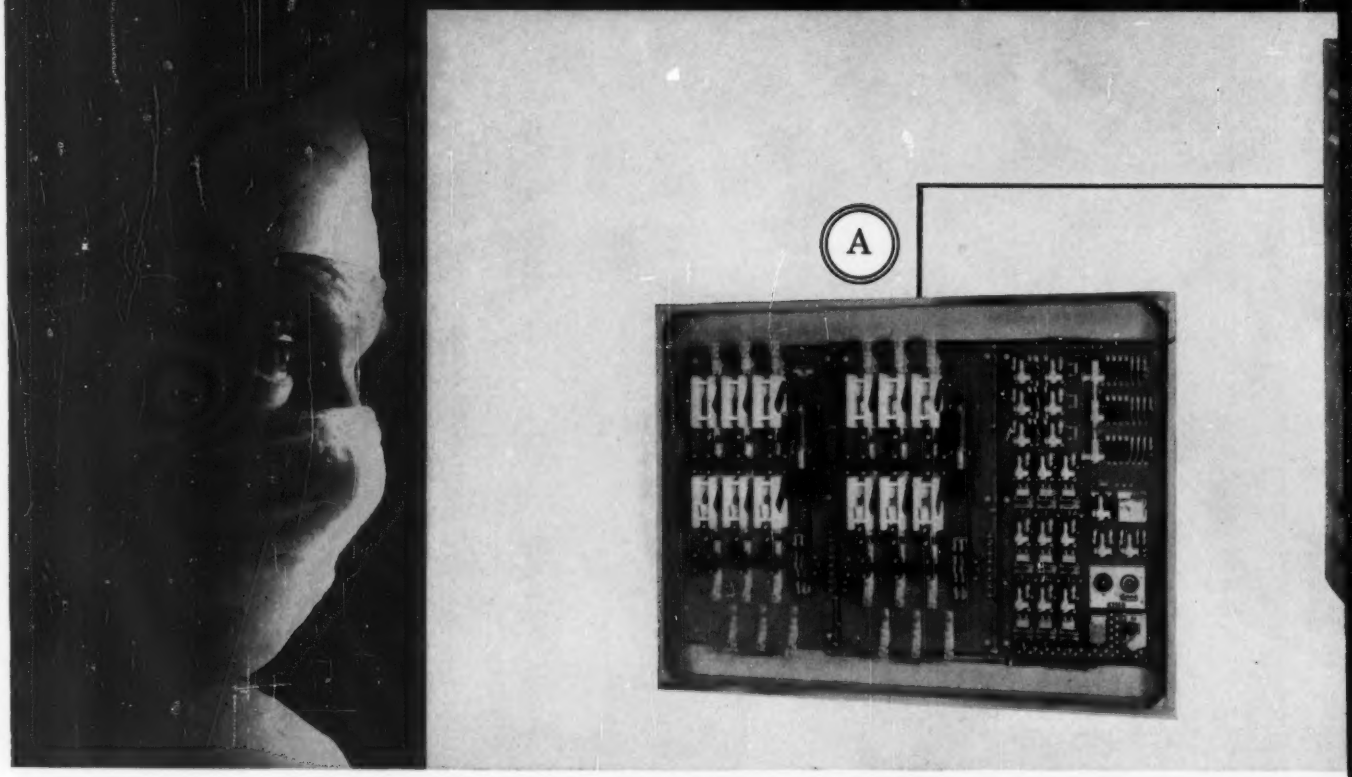
714 EAST 61st STREET • CHICAGO 37, ILLINOIS

1961 (S)ARCH. and/or Ind. Const. • *PAT. PEND. ©1960 AA WIRE PRODUCTS COMPANY ®REG. U.S. PAT. OFF.

CE

WHEN POWER

ASCO COMPLETE CONTROL SYSTEMS PUT



Here's how ASCO control system operates . . .

ASCO Automatic Transfer Switches, with built in selected time delay of ½ to 3 seconds, ignore momentary outages caused by transient conditions – thus protect generating equipment from false starts. However, once a sustained outage is detected, ASCO Control Systems put standby power in action – fast. Follow the cycle, step by step . . .

STEP 1 The instant a sustained outage is detected, a contact on the ASCO Automatic Transfer Switch (A) closes.

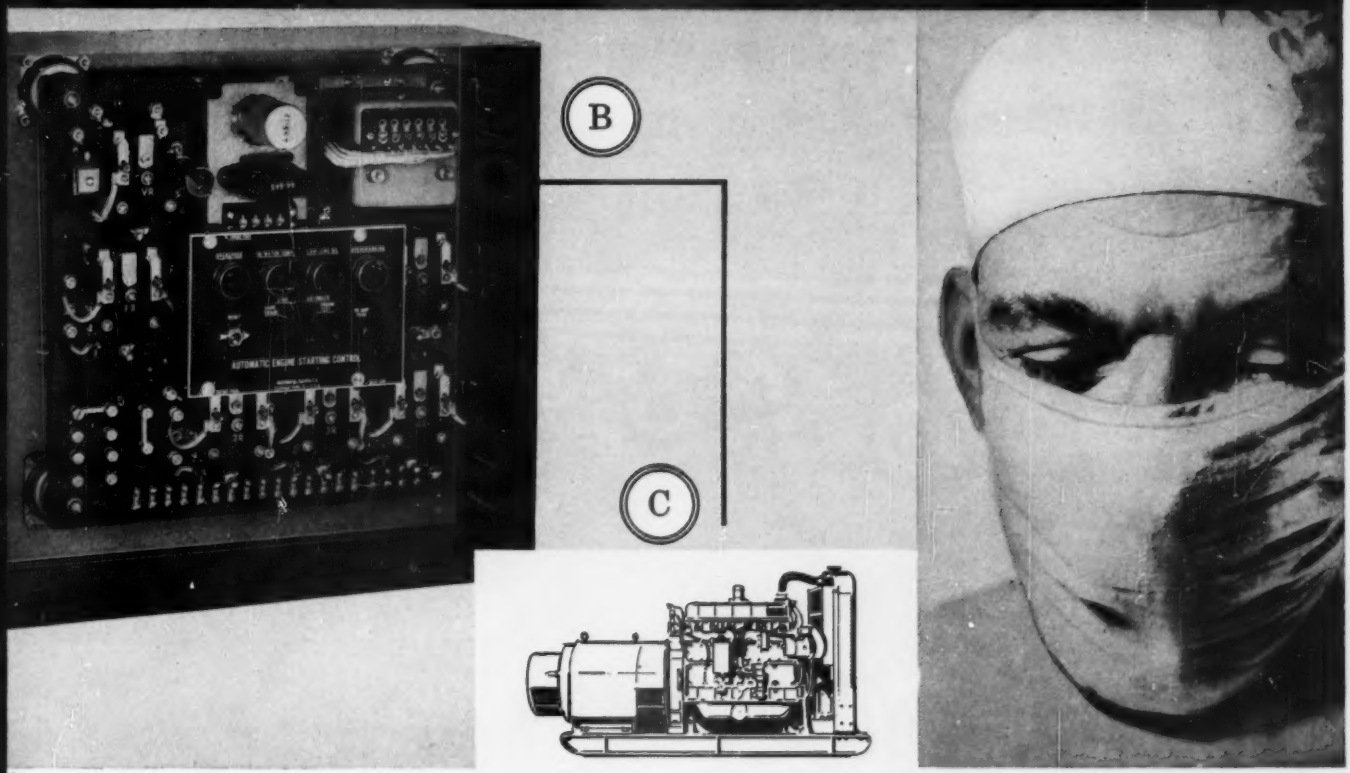
STEP 2 This energizes the ASCO Automatic Engine Starting Control (B), which opens the fuel control device on the generator and cuts in batteries to energize the starting motor and crank the engine (C).

Four on-off cranking cycles are provided. When the engine fires, the starting control automatically disconnects the cranking control.

STEP 3 When standby power source reaches proper voltage and frequency, the transfer switch transfers the load to the electric plant. Time of transfer – 1/30 to 1/6 of a second!

When normal power is restored, the ASCO Transfer Switch returns the load to its original feeder lines. The Starting Control then causes the electric plant to shut down.

STANDBY POWER IN ACTION – FAST



For Dependable Standby Power, ASCO designs and manufactures a complete line of emergency power and electric plant control equipment. In addition to Automatic Transfer Switches and Automatic Engine Starting Controls, this includes:

Solenoid Valves: For air starting applications, and for controlling the flow of cooling water, fuel oil and other liquids and gases.

Battery Chargers: To keep starting batteries charged, ready for engine starting.

Solenoids: For fuel control devices, operating shutters for engine cooling, and other electric plant applications.

Load Demand Controls: To automatically start engine when load is applied; stop it when load is removed.

For Detailed Information write for:

Catalog 57-S1 – Automatic Transfer Switches

Catalog 57-S5 – Solenoids

Catalog 57-S6 – Electric Plant Controls (including battery chargers)

Catalog No. 25 – Solenoid Valves

Dependable control by ASCO

ASCO Electromagnetic Control

Automatic Switch Co. 50-CC HANOVER RD., FLORHAM PARK, N. J., FRONTIER 7-4600

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

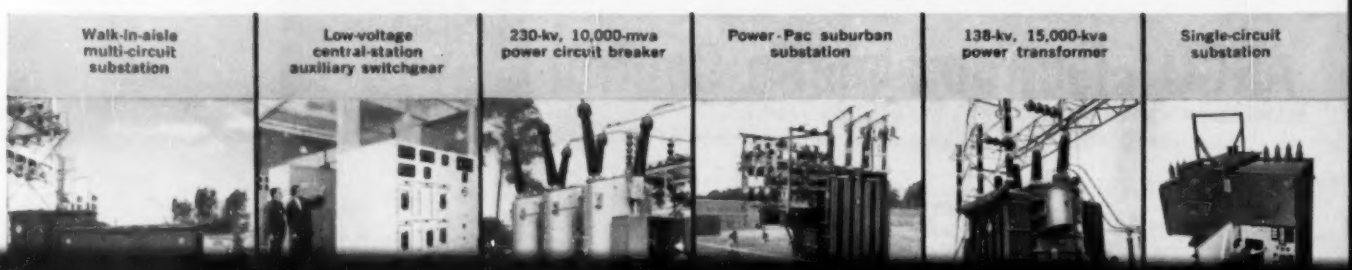
ASCO

New Allis-Chalmers transformer plant...

TERRE HAUTE.. TRANSFORMER — OIL CIRCUIT BREAKER — SWITCHGEAR PLANT...

includes a three-million-volt impulse generator and a 600,000-volt high potential test transformer installed in the transformer assembly building. These test facilities represent a 2½-million-dollar investment of the very latest design with maximum flexibility for testing all types of electrical equipment. The three-bay tank and plate shop contains some of the largest equipment in the industry — shot-blast room, 1000-ton forming press, 400-ton straightening press and a shear capable of cutting 1-inch-thick steel.

TYPICAL TRANSMISSION AND DISTRIBUTION EQUIPMENT MANUFACTURED AT TERRE HAUTE



West bay of the 130,000-sq-ft transformer assembly and test building showing transformers in various stages of manufacture. At right is the vacuum drying tank, one of the largest in the industry. Vacuum as low as 10 mm of mercury can be obtained . . . for efficient drying of transformers.

The industry's finest facilities for designing, building and testing power transformers are housed in the Allis-Chalmers Terre Haute Works. This investment features over 740,000 square feet of floor space. All product design and test developments are closely coordinated with five major Allis-Chalmers plants at West Allis, Wis., Pittsburgh and York, Pa., Gadsden, Ala., and Boston, Mass. These plants produce a complete range of generation, transmission and distribution equipment for industries and utilities.

The Terre Haute Works is typical of Allis-Chalmers look-ahead philosophy that has pioneered so many industry "firsts" in all phases of electrical generation, transmission and distribution. Also an integral part of this plant are the advanced facilities for building and testing oil circuit breakers and switchgear. *Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.*

ALLIS-CHALMERS

Pacing Power Progress

Shipment of Allis-Chalmers power transformers on railway spur line flatcars indicates the varied size and application range of these Terre Haute products.

A-1390

20,000-kva mobile transformer

IMPORTANT ANNOUNCEMENT

to people who hear voices*

*voices that intrude or disrupt and noises that project when they should be hushed.

The new Aircoustat® Model W Return Air-Vent Silencers stop the transmission of noise without blocking air flow

Aircoustat Return Air-Vent Silencers eliminate the distracting sound of voices that spill from one area to another. Their slim design gives you a choice of installation. You can install them within a wall or ceiling or hang them on doors or walls. Let Koppers long experience in sound control help you. Write today for information to: KOPPERS COMPANY, INC., 3601 Scott Street, Baltimore 3, Maryland.

Model W Return Air-Vent Silencer

In sizes for all applications:

Model	Thickness	Width	Length
W-1	3½″	30″	48″
W-2	3½″	42″	48″
W-3	5″	30″	48″
W-4	5″	42″	48″
W-5	7″	30″	48″
W-6	7″	42″	48″

KOPPERS

SOUND CONTROL
METAL PRODUCTS DIVISION
® *Engineered* Products Sold with *Service*

Readers' Comment

Engineering in Hungary

Congratulations on publishing the article "Slow Death of a Free Profession." I hope you will develop some editorial comment on this article indicating that a similar trend is developing in this country.

Adolph J. Ackerman
Madison, Wisconsin

Author's Comment

The appearance of my article on Hungarian consultants in November's CONSULTING ENGINEER is a very pleasant surprise. I want to thank your staff for their patience and interest in my material. I am especially pleased with your illustrator's work which strikingly captured the fading Hungarian scene.

Denis Gellert
New York City

Variations on a Theme

While reading "PR" by Richard Espey, in the November CONSULTING ENGINEER, I was amazed that the author would overlook one thing that gives the registered consulting engineer a professional definition. As pointed out by Mr. Todd in the same issue (p37), "A consulting engineer is a professional engineer who . . . " The term professional engineer is the only way that the consulting engineer of today can be defined. A man's name does not signify anything professionally, but the letters PE after his name give it a meaning far beyond that achieved by other methods of public relations.

It is the feeling of the Consulting Engineers of Indiana that the best means of establishing professionalism throughout is by the use of PE after the engineer's name.

G. B. Huntington, Jr., PE
President
Consulting Engineers of Indiana

Letter About a Letter

"Letter to a New Employee," in the October 1960 issue of CONSULTING ENGINEER, is of great interest to myself and other members of the staff of the U. S. Study Commission-Texas.

Our executive director, Mr. Charles D. Curran, would like to make a copy of this letter for each member of our staff. We would like to obtain your permission to make a copy of this letter so that our staff members may have it for ready-reference.

Many of the articles and briefs contained in your magazine I find very interesting and helpful.

Everett W. Rowland, PE
U. S. Study Commission-Texas

Plastic Cover

May we compliment you on the manner in which the November 1960 issue was mailed. If the plastice folder used to enclose the issues is not too expensive a way of mailing, we think it is excellent, and perhaps in due course will be adopted by other publishers. It keeps the edges of the magazine from being torn and it arrives in excellent condition.

Mildred E. Stone
Librarian
Ebasco Services

THE WORLD'S LARGEST!

Cobo Hall can feed 6,200 people at once—park 2,200 cars —provide 400,000 sq. ft. of exhibit area. Theoretically, 4 major trade shows, 33 meetings and a 3-ring circus with 9,600 spectators could function simultaneously in Cobo Hall and its attached convention area. Each exhibit booth has connections for water, compressed air, gas, drainage, and telephone service. ***The 10,000 KVA of power is distributed and controlled by Square D equipment.***

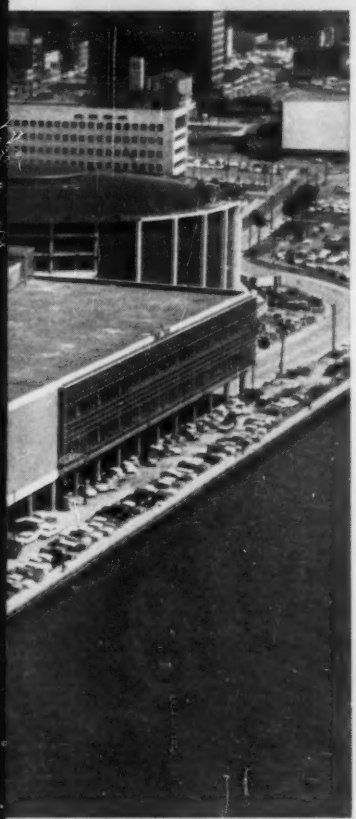
ALL THIS SQUARE D EQUIPMENT IN COBO HALL!

- *11 Substations*
- *37 Motor Control Centers*
- *28 Switchboards*
- *550 Panelboards*
- *100 Contactor Panels*
- *1 Mag. Amp. Dimmer Board*
- *10 Dimmer Panels*
- *64 NEMA 4 Circuit Interrupters*
- *120 Spotlight Control Panels*
- *19,000 feet of Lay-in Duct*

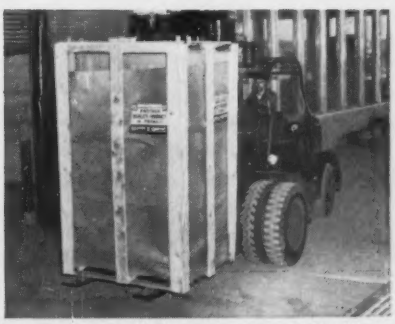
SQUARE D COMPANY

COBO HALL occupies 10 acres
of Detroit's Civic Center

electricity is distributed and controlled



Square D panelboards like this control Cobo Hall's vast lighting system. 100 foot-candles of light bathe the entire exhibit area.



Section of a substation arrives at Cobo Hall. Square D coordinated all shipments—reduced installation time.

Square D Field Engineer Don Selby (*right*) and Mr. Gil Brandt, Cobo Hall Project Electrical Engineer of Giffels and Rossetti, architects and engineers, examine a Square D 2000 KVA unit substation. The sections of each substation were factory-coordinated. Their reconnection at the job site required minimum time and labor.

A *Complete* LINE OF ELECTRICAL DISTRIBUTION AND CONTROL EQUIPMENT

ADJUSTABLE SPEED DRIVES
BUSWAYS & WIREWAYS
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PRESS CONTROL
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RELAYS AND CONTACTORS
RESISTORS
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SERVICE ENTRANCE EQUIPMENT
STAGE DIMMERBOARDS
STATIC CONTROL
STEEL MILL CONTROL
SWITCHGEAR & UNIT SUBSTATIONS
SYNCHRONOUS MOTOR CONTROL
TERMINAL BLOCKS
TEXTILE MACHINE CONTROL
TIMERS
VOLTAGE TESTERS
WELDER CONTROL

EXECUTIVE OFFICES • PARK RIDGE, ILLINOIS

From the Editor's

Tranquil Tower

New Pitch to New Clients

THE CURRENT changing of top Federal personnel offers a rare opportunity. There is a feeling that the Democrats will lean toward an increase in public works. This will mean more engineering, and it is up to consulting engineers to increase their proportionate participation. That may not be too hard to do, for with the new administrators and the new bureau chiefs there comes a new opportunity for a change in direction, a change almost impossible to effect once a wrong course has been set. And a wrong course had been set during the last eight years. It is an unhappy fact that all through the past administration, consulting engineers found themselves being rapidly replaced by government employee engineers. Not only was this trend all too clear at the Federal level, but it was also obvious that the U. S. Bureau of Public Roads provided the state highway departments with excuses for, if not active encouragement in, increasing their own engineering staffs and thereby eliminating consulting engineers.

Certainly, consulting engineers have no reason to be discouraged in their efforts simply because the new Administration is Democratic. The fact that there will be new men to deal with is more important than their political party allegiance. Private practice, in other words, gets another chance to present its pitch to a new group of prospective clients. Whether we succeed or fail depends to a considerable extent on how good the pitch.

Every consulting engineer and every association of consulting engineers should get busy immediately. Quite literally, there is not a week to be lost. Appointments are being made, jobs are being filled, and we should see to it that consulting engineers participate in this process in every way possible to promote the sound idea that engineering of public works should be assigned to private firms. This means that individual consulting engineers must be prepared to recommend and become the advocate of men they know will support the use of private practitioners for the engineering design of public works. It is the job of consulting engineers and their associations to do their utmost to get the right men appointed.

This means that you, as a consulting engineer, must not only be willing to recommend others but perhaps take some position yourself. Seldom do these positions provide sufficient pay. Almost all demand a sacrifice, but the consulting engineer who accepts an appointment can have the satisfaction of knowing that he is sacrificing for the good of his profession as well as his country. This is true for state as well as Federal appointments, for in some important areas of public works, such as highways, state officials have more influence than their Federal counterparts in deciding how and by whom highway engineering is to be done. It would be a great day for the public if all the state highway commissions were headed by qualified engineers with backgrounds in private practice. To have just one such man to serve as an example would be a fine step forward.

After the appointments are made, there is still much to be done. No matter how effective consulting engineers may be in sponsoring the appointment of men who are sympathetic to private enterprise, there will be failures — but these failures need not be defeats. The new officials, no matter how unreceptive they may seem, can be convinced if properly approached. Few men are entirely unmoved by logic, and it is unforgivable not to make the effort.

To convince these new officials of the basic good sense of using consulting engineers for the design of public works is one of the tasks assumed by Consulting Engineers Council. The Council has a good Private Enterprise Committee headed by Cliff Evanson, of Chicago; and a Highway Committee, under Hugh P. Duffill, of Boston. Both of these men are extremely capable, and both take their tasks seriously. Furthermore, they have some money to work with. This is, however, no small assignment. These men deserve the full support of every individual consulting engineer and every association interested in the promotion of good government and private enterprise. ▲▲

HERE'S HOW BORDEN FLOOR GRATING CUTS COSTLY FIELD CORRECTIONS . . .

Insures correct dimensions, fit, and placement . . .

1. A shop drawing of the job is submitted to the customer for approval, when necessary. This plan shows the size and shape of the grating area — how grating clears all obstructions.
2. Each finished panel is carefully checked for accuracy of dimensions.
3. Each panel is plainly marked with its number to insure quick, easy installation.
4. The entire platform is laid out on our shop floor. Overall dimensions and obstruction openings are checked against shop drawings.
5. Erection diagram showing panel mark numbers is supplied for field installation.

Write today for *free*
16-page catalog showing all basic types of grating; more than 30 dimensional drawings of subtypes; eight safe load tables for steel and aluminum grating.

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Gentlemen: Please send me NEW 1961 BORDEN Catalog

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TITLE _____

COMPANY NAME _____

ST. AND NO. _____

CITY AND STATE _____

1

City of Binghamton sees clear water ahead for a full generation

Westinghouse Powers-Up New Filtration Plant to Meet Rising Demands of Next 30 Years

Present population: 85,000—growth reaching at least 105,000 by 1975. This is the future for Binghamton, booming city in upstate New York. With this fact in mind, planning of their new 4,000,000-dollar filtration plant accented expandability for rapidly increasing water demands to 1990.

Westinghouse has provided a power distribution system that will assure this objective. With present pumps and treating equipment, total capacity is 31,000,000 gallons per day. Plant capacity can be expanded 50% during the 30-year period without additional substation, bus or switchgear equipment. Beyond basic flexibility, the electrical equipment will be called upon for absolute, 24-hour reliability for this projected long life span. Westinghouse power components are coordinated to work together, and will fulfill this objective also . . . dependability, with minimum servicing or maintenance.

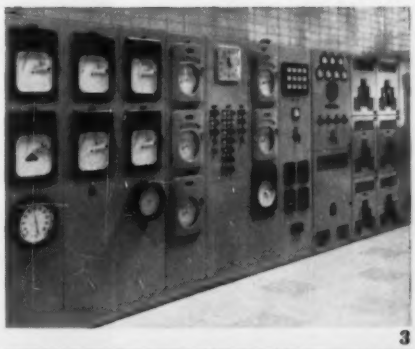
For look-ahead electrical planning and products to match, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

You can be sure . . . if it's Westinghouse.

Westinghouse

J-94152-2

2



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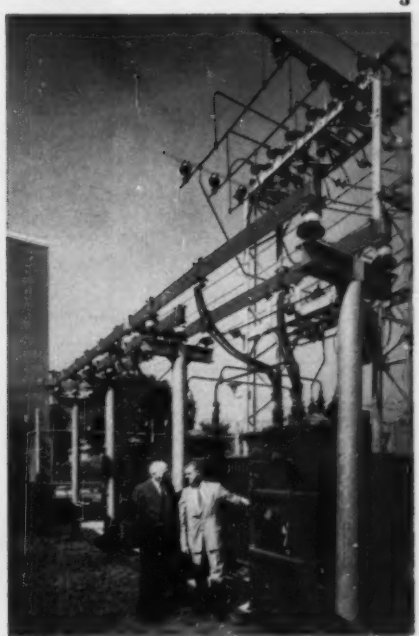

5

1. The Susquehanna gives up its water . . . Pipe gallery located under the filter operating floor houses raw water, backwash and waste water lines, control piping and valves.

2. Strength, beauty and simple utility . . . Plant exterior is finished in blue glazed brick, yellow porcelain enameled steel panels, anodized aluminum trim.

3. Utilized plant control . . . Main distribution center for new plant provides power to motor and auxiliary feeder circuits. Fed by 4000-ampere ventilated low-impedance bus duct, board consists of (right to left) plant service transformer and power panels; 480-volt switchboard with incoming line and motor feeder breakers of reliable DB design; control panels including flow and pressure indicators, gauges and master indicating lights to show status of all plant operating equipment. Entire unit was assembled by Westinghouse and delivered complete and prewired for fast, easy installation.

4. Mr. G. E. Rickard, Water Superintendent, checks ammeter reading at incoming switchgear and master control board with Mr. R. C. McNamara, City Engineer, who supervised over-all construction project.

5. Dependable power for 30 years . . . G. E. Rickard and R. D. Batley, Westinghouse Sales Engineer, discuss one of three Westinghouse SL transformers in plant outdoor substation. Present bank capacity is 2500 kva—future uprating to 2875 kva is possible through provisions for addition of forced air cooling. Westinghouse transformers feature exclusive Insuldur® insulation and Hipersil® grain-oriented steel cores to give extended life and higher efficiency. This substation, furnished by Westinghouse, also includes: 15-kv, 600-ampere, 100,000-kva IC oil circuit breakers; Type V disconnect switches; Type S station service transformer; main low-voltage bus as well as the integrated steel structure.

6

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J-94152-3

Filtration Plant Powers-Up for Next 30 Years
(cont'd)

OWNER: *City of Binghamton*
GENERAL CONTRACTOR: *Smith-Howard and Sprague, Binghamton, N. Y.*
ELECTRICAL CONTRACTOR: *Lord Electric Co., Inc., New York, N. Y.*
CONSULTING ENGINEERS: *Leonard S. Wegman Co., New York, N. Y.*
Alexander Potter Associates, New York, N. Y.
ELECTRICAL DISTRIBUTOR: *Westinghouse Electric Supply Co., Long Island City, N. Y.*

6. Compact, expandable motor control . . . These Westinghouse units, together with the lighting panelboard (door open), centralize control for all auxiliary equipment in the chemical building. Motor starters serve mixers, drives, pumps. Thirty-kva transformer, feeding panelboard, completes assembly. Blank sections, at left, permit future additions.

7. Control for added capacity . . . Starters for high lift pumps include two new Westinghouse reduced voltage autotransformer types to complement several starters moved from original plant. Control accessories were added to modernize these—thus providing an economical conversion to the new control scheme. Westinghouse starters were used to control new 600-hp high lift pump and 125-hp wash water pump.

8. Close cooperation among the consulting engineer, electrical contractor and Westinghouse makes it possible for Binghamton to provide for the future today. Seen at left: A. J. Juris and E. J. Young of Lord Electric Co.; E. Piller, Westinghouse Electric Supply Co.; P. J. Gallagher, Westinghouse; and J. J. Fenley of Lord.

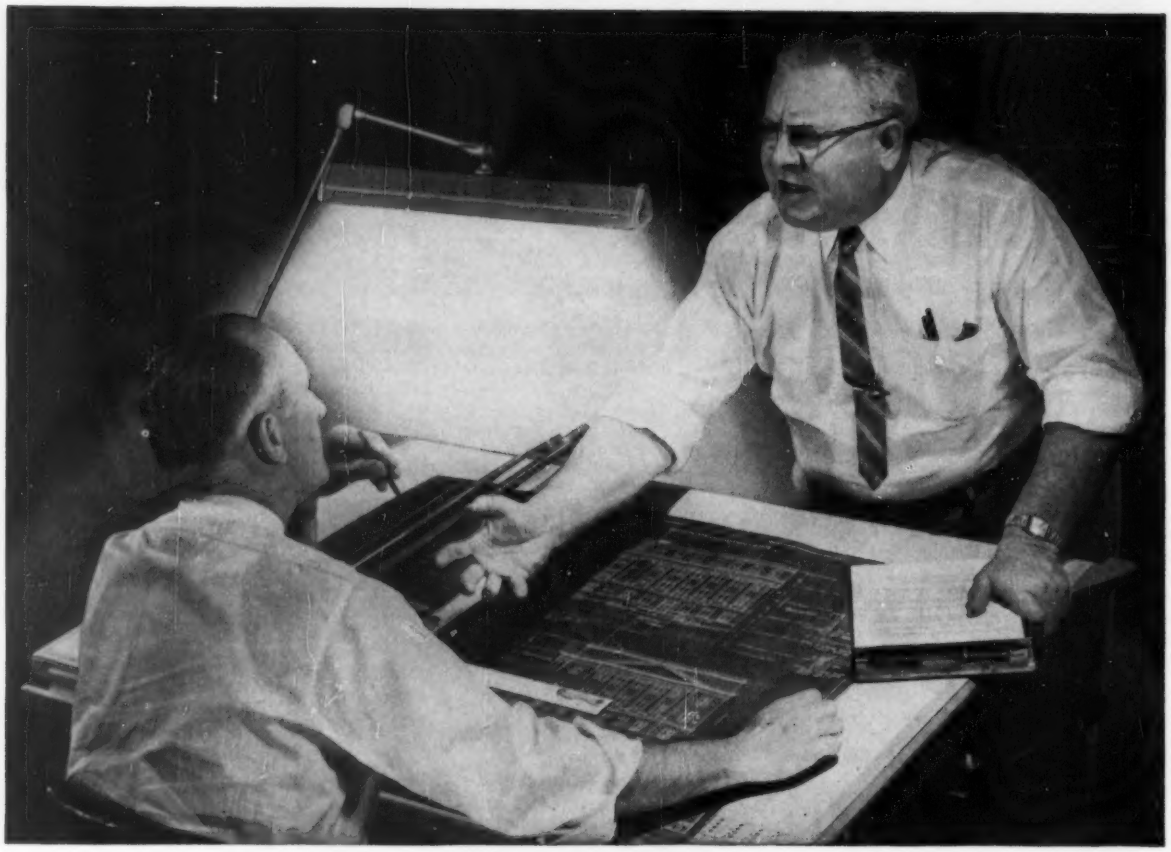
9. Color and light welcome visitors . . . Lobby area is handsome with terrazzo flooring, marble paneling, mosaic tile stair wells. Westinghouse Mainliner fluorescent luminaries blend with building's structural elements. Average illumination intensity is 90 foot-candles.

10. Room for more . . . C. E. Ahern, filter operator, seen at Westinghouse NLAB lighting panelboard which contains normal and emergency breaker sections with spares for future circuits. Flush trim and special brass hinges harmonize with architectural detail of plant.

11. Take water, add chemicals, mix well . . . G. E. Rickard and R. D. Batley inspect the slow mix tanks. Settling tanks in background provide 3½-hour detention. Entire area is illuminated at night to promote safe operation and permit 24-hour observation of flocculation process.

J-94152-4

Westinghouse



"Explosion-proof EXIT *signs!*

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As you can see, they found the explosion-proof exit sign. It's Crouse-Hinds No. EVA139.

Look in your Crouse-Hinds catalog, of course. There's nearly everything you could want for hazardous areas listed there. Nine different types of explosion-proof telephones... horns, bells, clocks, pilot lights, instrument enclosures, gauge lights. Even X-Ray film illuminators. And, of course, modern designs in all the familiar explosion-proof motor controls, switches, plugs, receptacles, panel boards and lighting fixtures. UL-listed for every Class and Group in Article 500, National Electrical Code.

So, whether you're looking for conventional or out-of-the-ordinary explosion-proof electrical devices, contact Crouse-Hinds. If you design, buy or work with hazardous-area equipment, a Crouse-Hinds catalog should be on your desk. Ask your Crouse-Hinds Representative.

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Heard Around Headquarters

MARJORIE ODEN, Eastern Editor

Are Your Clients Here?

One-third of the industrial space at the 1964 World's Fair has been leased and more than 400 firms have inquired about the remaining space. Fair officials are proceeding slowly on definite commitments for the remaining areas, trying to get the best possible representation of American industry.

Many of the firms listed below have not yet selected their consulting engineers, and some still are looking around for architects, according to Brig. Gen. William Whipple Jr., the Fair's chief engineer. If one of your former or potential clients is listed, there still is a chance to get the project.

The largest space available (50,000 sq ft) has been taken by the following: American Gas Association, American Telephone & Telegraph Company, P. Ballantine & Sons, The Bordon Company, Chase Manhattan Bank, Eastman Kodak Company, Edison Electric Institute, General Electric Company, International Business Machines, Liebmann Breweries, Inc., National Dairy Products Company, Pavilion of American Interiors, Pepsi Cola Company, Radio Corporation of America, Singer Sewing Machine Company, and Travelers Insurance Company.

Smaller areas have been taken by Aluminum Company of America, American Optical Company, Arnold Baking Company, Coca Cola Company, Corning Glass Works, du Pont de Nemours & Company, Institute of Life Insurance, Schaefer Brewing Company, and Westinghouse Electric Corporation.

Space in the Transportation Section will not be limited to a 50,000 sq ft maximum. The real plums will go to the consulting engineers who get General Motors and Ford Company projects. Each has applied for seven acres.

Perhaps the best prospects for consultants right now are the foreign countries. Since nations move much slower in making final plans than do industries, chances are good that many have not yet named American consultants. Due to the Fair's building code, it will be practical, if not absolutely necessary, to use an American firm.

The countries which definitely will have buildings are Mexico, Chile, Nationalist China, Bulgaria, Italy, the Vatican, and the Soviet Union. They can be contacted through their embassies.

Plans have advanced on schedule for the Fair Corporation's projects. In addition to the projects and firms listed previously ("Field Notes," November 1960), Tippetts-Abbett-McCarthy-Stratton has been retained to study the waterfront. At Flushing Bay, many small boats currently are moored. Since the Bay already is connected with Fair property by interior roads, TAMS is investigating the potential for further development of the Bay to allow mooring and docking facilities for larger craft. TAMS also is taking into consideration possible development of the Flushing River.

The transportation system, which General Whipple previously described as unique, still is a mystery. All the General will say is that at this time preliminary plans have been submitted covering "all conventional elements" of the system. There is a possibility that details on the transportation may not be announced until nearer the Fair opening when they would have more publicity value.

As for timing on the Fair's utilities and other basic facilities, General Whipple said "We are proceeding right on schedule. Preliminary plans have been approved for such things as sewer and storm drains, and the other plans are coming in as planned."

The World's Fair Corporation personnel were scheduled to move into their new administration building by January 1.

New Views on Pirates

The National Society of Professional Engineers is publishing a new statement of professional policy this month. The revision regarding the pirating of employees states:

"An individual professional engineer has the right to seek and accept other employment in his field, provided the seeking and acceptance of such other employment is consistent with the Canons of Ethics and the NSPE Rules of Professional Conduct as they pertain to relations with clients and em-

ployers. NSPE looks with disfavor on any provisions in contracts, or conditions of employment, which limit the individual's choice of employment.

"The National Society of Professional Engineers further declares that for every right there is a corresponding responsibility, and a professional engineer employee should assume his responsibility of loyalty to his employer and should normally notify his employer of his desire and reason for a change of employment prior to seeking such other employment, provided there are reasonable grounds to believe that the employer will not thereafter discriminote against or otherwise jeopardize the status of the employee as a result of such notification."

Getting There

The New York Association of Consulting Engineers, which began a concerted drive about one year ago to get additional large civil engineering firms as members, has added Praeger-Kavanagh and Parsons, Brinckerhoff, Quade & Douglas to the roster. This brings the total of New York Association members doing civil engineering to 19. Total membership is 65 firms.

The Maryland Case

A contractor in Maryland, who sought registration without taking an examination, has been ordered by the Maryland Court of Appeals to take the examination.

The case began in 1953, when J. W. Ruth, a vice president in Langenfelder Construction Company, applied for registration. Among his character references was that of Gustav J. Requardt, of Whitman, Requardt & Associates, Baltimore.

The board ruled that although Ruth had adequate education (a graduate of Pennsylvania State College in industrial engineering), his experience was in contracting and not engineering. This opinion was reversed by the Circuit Court of Baltimore County, which in turn was reversed by the Court of Appeals in Maryland.

Ruth's case was further complicated by the lack of funds of the Maryland registration board. For a period last year, the board had received no funds from the legislature. Thus, it was impossible for a person to become registered. This situation has been corrected.

From the ASME Meeting

The American Society of Mechanical Engineers will work with the National Society of Professional Engineers and the American Institute of Electrical Engineers toward implementation of the modified functional plan for unity. It has already found itself in agreement with NSPE on something else — the revised Model Law.

NSPE endorsed the new Model Law at its convention in Denver last October. Thus, ASME, at its annual meeting early last month in New York City, became the second group officially to endorse the revised law. ASME announced the endorsement "in accordance with previously adopted policy."

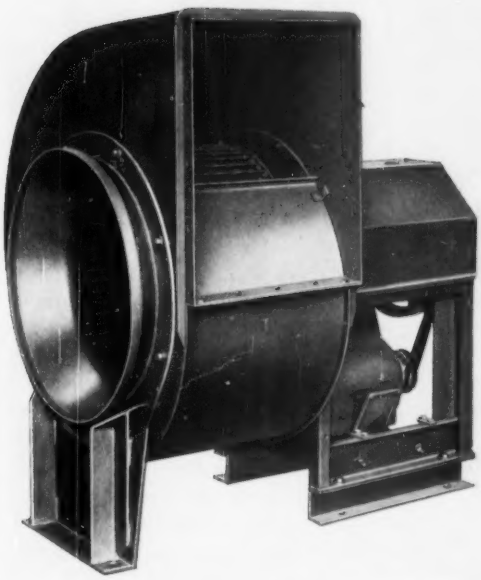
A progress report on unity also was released by ASME at the New York City meeting. An ASME official has told CONSULTING ENGINEER that the official announcement of its action on the modified functional plan will be given ASME members in January. What they currently are being told — unofficially — is:

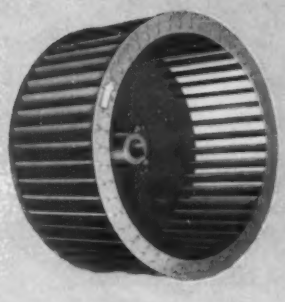
"To date, the work of your committee (ASME Intersociety Relations Committee) has been carried forward with other societies on a confidential basis by a small negotiating group. The discussions have been informal and unofficial. A position of confidentiality exists solely because we feel that in negotiations of this type a rigid or publicly stated opinion is prejudicial to success.

"It does seem appropriate to remark, however, that at least on an informal basis there appears to

CLARAGE

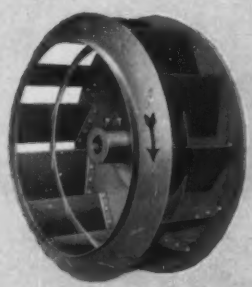
New line of
V-belt driven
Ready Units





LS Ready Units have Low Speed, forward curved blade wheels. These are of the long-recognized Clarage Type HV multiblade design.

or



MS Ready Units have Medium Speed, backward inclined blade wheels with non-overloading horsepower characteristic. These are of the highly regarded Clarage Type NH, Class I design.

Exceptionally sturdy, quiet, ready-to-run fan sets

- for volumes up to 25,000 CFM
- for static pressures thru 2½″
- for clean air up to 300° F.

Distinguishing points — over 15 of them — make these new Clarage units outstanding.
To mention a few: Better motor ventilation . . . entire drive within frame of unit . . . complete accessibility to motor, drive, and bearings. Learn more about the numerous specific advantages that mean greater value to you from Clarage. Request Catalog 517 . . . 36 pages of complete information, selector charts, capacity tables, dimensions. Clarage Ready Units are ideally suited for supply or exhaust jobs — indoors or outdoors — for buildings of all types, all sizes.

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be a high degree of mutual understanding among ASME, AIEE, and NSPE. . . ."

Meanwhile, William H. Byrne, new ASME president, said he thinks unity is merely a matter of a "little honest horse-trading" among the various engineering groups, and he expects to see them all joined in a unified group within two years. "I do not think that previously announced positions will be any barrier to future agreements. After all, officers of Founder Societies change, and with changes come new viewpoints."

Byrne, during his term of office, also plans to devote much of his time to membership activities. The present ASME membership is 58,000, and Byrne thinks that more attention to the small chapters could result in considerably increased membership. He would do this through better internal communications in the society and also by giving small chapters more help in planning interesting programs.

Since Byrne is a consulting engineer, he was asked if he hoped to see any cooperation between the Consulting Engineers Council and ASME. "Certainly. In fact, I would be willing to form a joint committee with CEC to discuss any mutual problems that might arise in the future. My only reservation would be in seeing that ASME took no part in legislative activities specifically concerned with private practice. After all, ASME has members working in government, education, and industry, as well as private practice. It would be unfair to promote any single group. But I do think a joint committee has possibilities."

Decision Needed

The National Society of Professional Engineers and the Consulting Engineers Council have been working toward a joint objective – eliminating the unqualified persons listed as engineers in the yellow pages. Both have met with American Telephone & Telegraph officials, and

both have requested that the situation be corrected. But they do not agree on what the correct listing method should be.

To help clarify the situation, NSPE has scheduled:

¶ A meeting with CEC officials in St. Louis. This was held recently with unannounced results.

¶ The mailing of two questionnaires. This is being done this month and next. The first questionnaire is being sent to approximately 800 consulting engineers asking what type listing they would prefer, and the second to a similar number of NSPE members selected at random.

Meanwhile, individual state groups have continued their efforts to get the telephone company to police listings.

In New York, the New York State Association of Consulting Engineers and the New York State Society of Professional Engineers jointly asked the attorney general to give the telephone company an opinion as to who could legally call himself an engineer. The attorney general dodged this one by saying any such request must come from the New York State Education Department.

Moonlighting Policy

The ethical practices committee of the Minnesota Association of Consulting Engineers recently worked with officials of the Institute of Technology, University of Minnesota, on compillation of an official policy on outside work.

The University's rules in regard to consulting by faculty members state that:

¶ All requests for consulting work by members of the faculty are referred by the Dean to the President's office for approval.

¶ Faculty members are requested not to use letterheads of the University for outside consulting engineering correspondence.

¶ The University charges 5 percent of the fee obtained by a faculty member for any equipment or fa-

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The 67 people in this photograph may not think about it, but they can shop with the assurance that a raging fire will not suddenly engulf the store. That's because in most of the nation's 11,494 department stores, even as in the one above, automatic *steel pipe* fire protection systems safeguard lives and property. In fact, wherever there is progressive management—be it in business or industry—there you will find fire prevention systems protecting the public, employees, property, goods.

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C-10

cilities owned by the University used in conjunction with consulting engineering.

¶ The University only does testing work of a type that requires special equipment that is not available in this area. Any requests for testing of any kind that can be done by laboratories is referred to local laboratories.

¶ The amount of work which faculty members may take on is governed, in the case of full time members, so as not to conflict with their contribution as faculty members of the Institute of Technology.

Clear Case of Voodoo

There is a possibility that the McCamy Case in New Jersey will be resumed this month. This is the case in which a New Jersey consulting engineer is accused of practicing architecture. As a result, the architectural and engineering organizations have spent most of the past year defining their professions.

The McCamy Case has been jinxed from the beginning. The original trial board consisted of two engineers, two architects, and a representative of the attorney general's office. One of the engineer representatives died, another trial board member suffered a heart attack, and still another has been hospitalized. Now the attorney general's representative has been appointed a County Court Judge in Hudson County. ▲▲

Printing Error in December Issue

The publishers of CONSULTING ENGINEER regret that the line "A Product of Horace T. Potts Company" appeared in error below the advertisement of Kerrigan Iron Works Company on page 59 of the December issue. It should have appeared below the advertisement for Speedline Fittings on page 53.

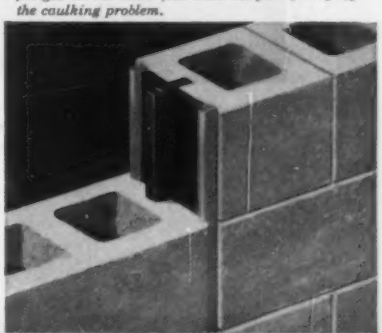
it takes Dur-o-wal to keep them alike!

Two masonry walls: They can be twins in surface charm and solidity. Yet, one can be the better building investment—free of maintenance problems for important extra years. That's the one built with Dur-o-wal, the original steel masonry wall reinforcement.

A wall reinforced every second course with Standard Weight Dur-o-wal has 71 per cent greater flexural strength than its unreinforced counterpart.

With its trussed design, butt-welded construction, scientifically deformed rods, Dur-o-wal is considered the most practical thing of its kind by builders everywhere. Nationally wanted, Dur-o-wal is nationally distributed. Wherever you build a masonry wall, you can get Dur-o-wal.

Two engineered products that meet a need. Dur-o-wal reinforcement, shown above, and Rapid Control Joint, below. Weatherproof neoprene flanges on the latter flex with the joint, simplify the caulking problem.



DUR-O-WAL®

Masonry Wall Reinforcement and Rapid Control Joint

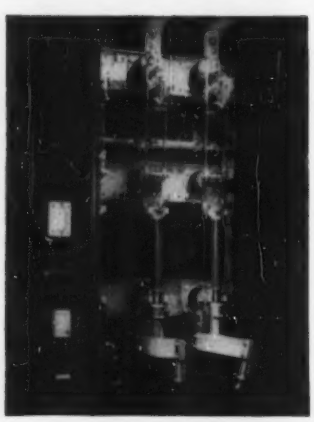
RIGID BACKBONE OF STEEL FOR EVERY MASONRY WALL

DUR-O-WAL MANUFACTURING PLANTS

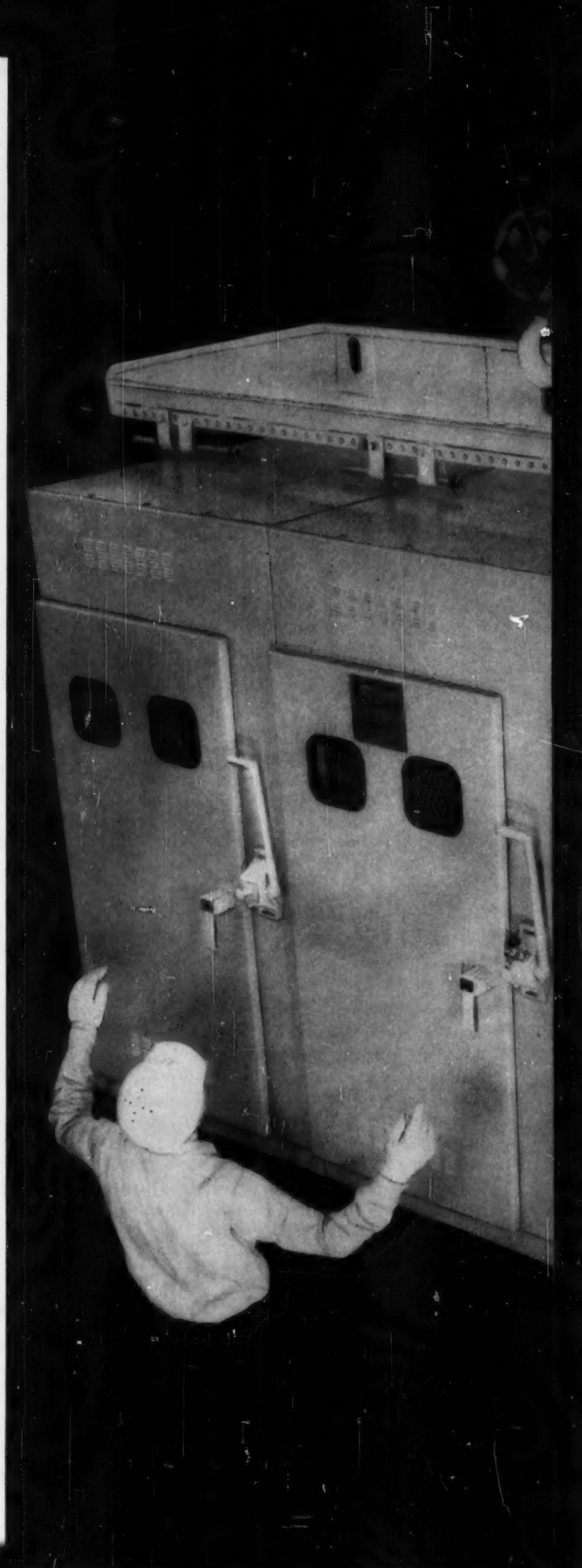
- Dur-O-wal Div., Cedar Rapids Block Co., **CEDAR RAPIDS, IA.**
- Dur-O-wal Prod., Inc., Box 628, **SYRACUSE, N. Y.**
- Dur-O-wal Div., Frontier Mfg. Co., Box 49, **PHOENIX, ARIZ.**
- Dur-O-wal Prod., Inc., 4500 E. Lombard St., **BALTIMORE, MD.**
- Dur-O-wal of Ill., 260 S. Highland Ave., **AURORA, ILL.**
- Dur-O-wal Prod. of Ala., Inc., Box 5446, **BIRMINGHAM, ALA.**
- Dur-O-wal of Colorado, 29th and Court St., **PUEBLO, COLO.**
- Dur-O-wal Inc., 1678 Norwood Ave., **TOLEDO, OHIO**
- Dur-O-wal Ltd., 352 Mac Nab St. North, Postal Station B, **HAMILTON, ONTARIO, CANADA**

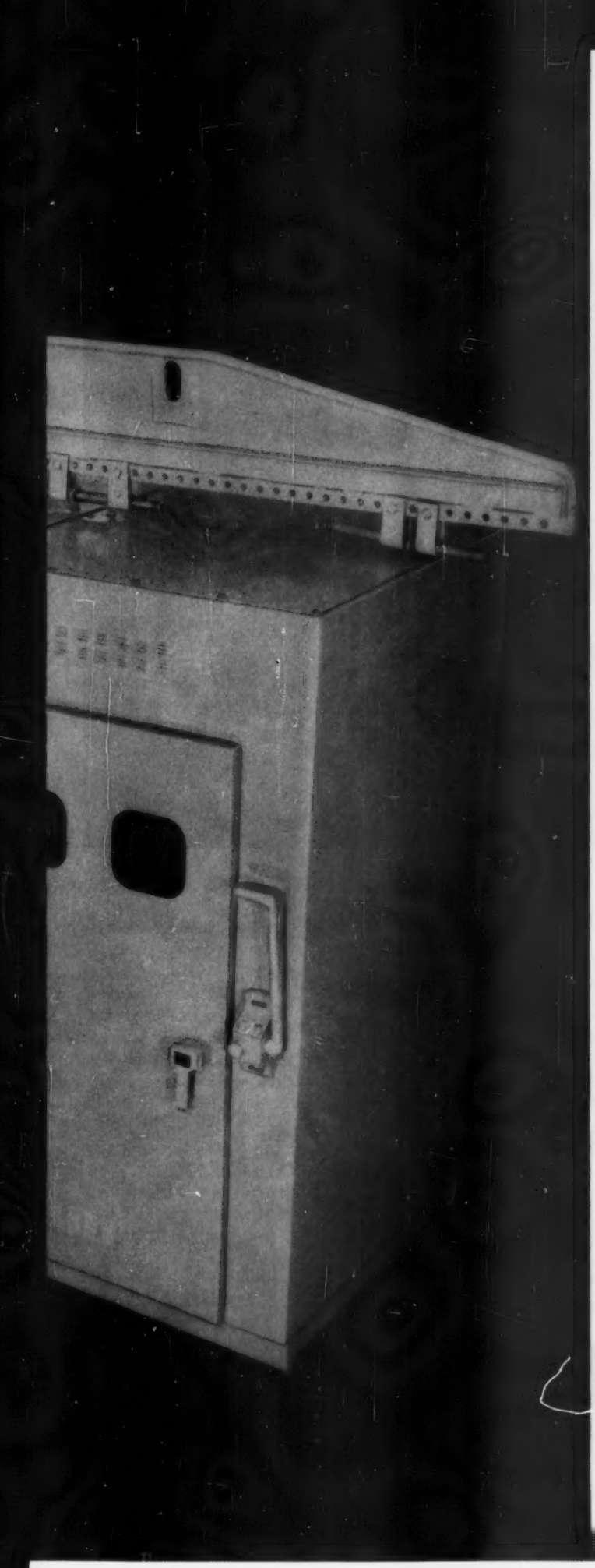
FAULT PROTECTION

ONLY 125 LB. PER SQ. FT.



Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.





S&C Metalclad Switchgear weighs 60% less — requires 50% less floor space

This S&C Metalclad Switchgear unit, rated 13.8 kv, weighs only 4500 lb., requires only 36 square feet of floor space (excluding aisle space), yet costs only $5,000. Why? Through the simplicity of S&C's design. Power fuses provide fault protection and load interrupters do the switching. Result: the most dependable yet most economical protection possible for high voltage power circuits in industrial and commercial installations. Besides initial low cost here's how else you save:

Low installation costs. Because S&C switchgear is lighter it's easy to uncrate, handle and move into place. Often you can utilize space on roofs or balconies without the expense of reinforcing. The S&C unit shown here weighs only 125 lb. per square foot—60% less than other types of metalclad switchgear.

Less floor space. S&C switchgear is shallower. (The unit shown here is only three feet, eight inches deep.) It can be backed against a wall since rear access is not required. No extra floor space is needed at the front for drawout. So you can cut your floor requirements 50%.

Power fuses give protection against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults and so don't need the automatic reclosing feature of the circuit breaker.

S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

S & C ELECTRIC COMPANY

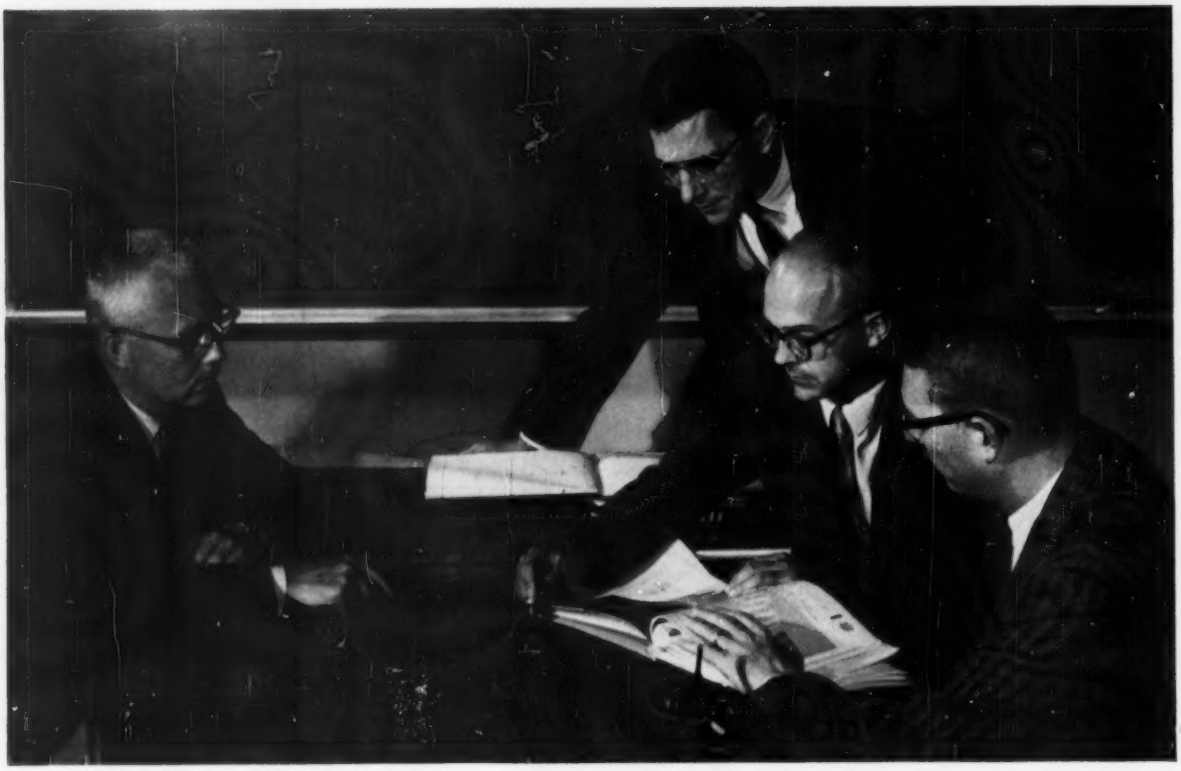
4436 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

S&C

SILICONE NEWS from Dow Corning

Blueprint for Reliability



For Performance Plus...Specify Silicone Insulated Transformers

Here's Why—(1) *Low cost installation* . . . transformers using silicone insulation systems are up to 50% lighter, 50% smaller and require no costly vaults or barriers. (2) *Lower operating costs* . . . silicone insulated transformers are virtually maintenance-free — have no liquids to filter or change — need no space heaters to keep de-energized windings dry. (3) *Maximum safety* . . . silicone insulated transformers are completely dry. There's no danger of toxic fumes, or fire. (4) *Maximum reliability* . . . silicone insulated transformers operating at 200 C have a longer life expectancy than Class A transformers operating at 100 C. Depending on design, silicone insulated transformers withstand overloads of 25 to 50% above rated capacity. Units have been flooded without damage to windings.

Here's How — Dow Corning silicone insulation has excellent electric strength and is unaffected by thermal cycling and high temperature . . . enables transformer manufacturers to (1) produce lighter, more compact units — units that double capacity without increasing space or weight requirements; or (2) build units that withstand substantial overloads.

Here's What — Silicone insulated dry-type transformers in three enclosures: (1) open, (2) enclosed and (3) gas-filled sealed.

Here's Where — For power station auxiliaries, a choice of enclosed, open or sealed gas-filled dry-type transformers — and, for underground distribution systems, sealed gas-filled dry-type transformers.

Here's When — Right now! Whether you are planning for future growth, expanding present facilities or replacing old equipment, consider the possibility of using silicone insulated transformers. Initial price is competitive, and, when you consider their lasting values, silicone insulated transformers give you more for your money . . . a whole lot more!

Write today for 8 page brochure entitled "Specify Silicone Insulated Motors and Transformers and Save!"

You Save by Specifying
Silicone Insulated Transformers.
Write Dept. 2313.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

Highways and Urban Development

A program is under way to coordinate joint planning of highways and urban development in metropolitan areas. Highway and urban planning funds will be available for combined use in comprehensive urban and metropolitan planning.

Federal highway legislation authorizes the use of 1½ percent of total program funds for planning and research work in connection with the Federally-aided highway program. Such funds are allocated through the Bureau of Public Roads.

At the same time, the Housing and Home Finance Agency makes grants for planning in metropolitan areas, as well as for programming of urban renewal activity on a community-wide basis in individual localities. Coordination currently is carried on largely through case-by-case consultation between the Federal, state, and local bodies involved. An agreement among Federal agencies provides for a joint use of highway and urban planning funds in regions where combined projects are in the process of development.

A Joint Steering Committee representing the Department of Commerce and the Housing and Home Finance Agency, will have over-all responsibility for encouraging joint projects, and will review and evaluate progress of experimental joint planning undertaken in metropolitan areas.

Regional Joint Committees from the two agencies will be set up to encourage and assist in the joint use of highway and urban planning funds in metropolitan areas prepared to carry out these projects. Either state or local agencies may initiate a proposal for a jointly financed planning project, but the project must be jointly sponsored by a state, metropolitan, or regional planning agency eligible for urban planning grants, and a state highway department.

Missile Destroyers

The Department of Defense is trying to stay a step ahead of itself in space weaponry. Even though they cannot control satellites, government engineers and scientists are thinking of ways to combat them.

The military is planning a "satellite destroyer." This vehicle would chase, identify, and destroy unfriendly satellites. Proposals for knocking out a satellite include sand spread in its path, high frequency radiation, and nuclear explosion.

Expense Accounts

The Internal Revenue Service is not content with new regulations to reduce expense accounts. The tax men want even tougher rules on deductions for unusual expenses, such as lodges and yachts.

To back up their case, the revenue officials have decided not only to scrutinize 1960 tax returns, in which large entertainment expenses must be listed separately, but also to look at company entertainment deductions for at least the past few years.

Results of this study of new and past returns will be cited to ask Congress to approve stricter regulations in 1961.

More On Missiles

The Army Corps of Engineers is wondering when the people who count — top Pentagon officials, Congressmen, and prime contractors — are going to realize fully the importance of ground support equipment for missiles.

The Corps, which handles missile ground support equipment, is basing its case on this statistic: ground support accounts for 78 percent of the cost of missile launching.

Goldwater On Economics

The foremost Republican name on Capitol Hill in the 87th Congress will be Barry Morris Goldwater, Republican of Arizona. The Senator, who has a growing following, is the symbol of conservatism on

the Republican side of the Senate. He stands in direct opposition to the liberal or "Rockefeller" wing.

A few of his thoughts on economic matters:

¶ Business is restricted right and left by the growing Federal bureaus and agencies . . .

¶ Industry should adopt incentive systems . . .

¶ Graduated income tax is confiscation — a plan to redistribute the nation's wealth . . .

¶ We must make America strong economically. Business must be released from strangulation by the government . . .

¶ Free enterprise, without bureaucratic direction, can forge the nation's economic power for maximum productivity.

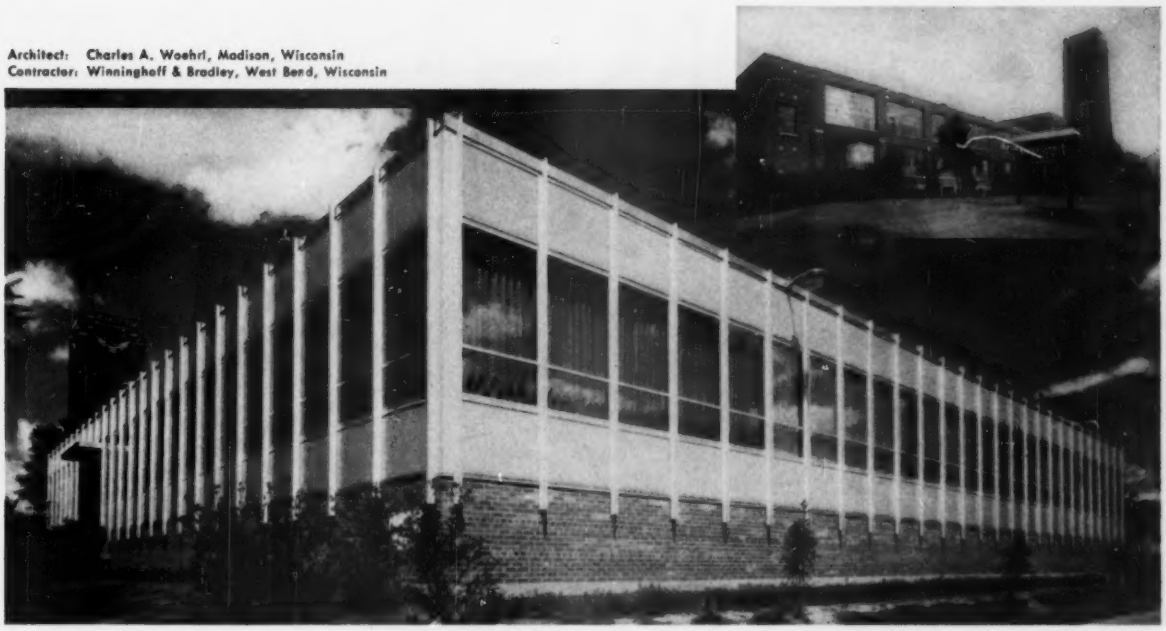
Senator Goldwater is convinced that the long-term trend toward socialism and centralization is going to meet more determined opposition in this Congress than it has in many years. He believes this determined opposition will grow out of more centralization and regulation legislation, which the Kennedy Administration is expected to support. Goldwater can be expected to lead the anti-administration camp.

Tax and Highway Reports

There is every indication that a real scrap is shaping up in the new Democratic controlled Congress in connection with the accelerated highway construction program. The entire highway industry program, as well as numerous trade associations, is interested in the two highly significant reports which have been presented to the Congress.

The Bureau of Public Roads has completed its report of a four-year study on the subject of tax equality. The exhaustive study, which is stirring up much controversy, makes an evaluation of the various benefits to highway users and nonusers. Even before the report went to Capitol Hill, it was known within trade circles that the benefit-to-cost ratio of the 41,000-mile Inter-

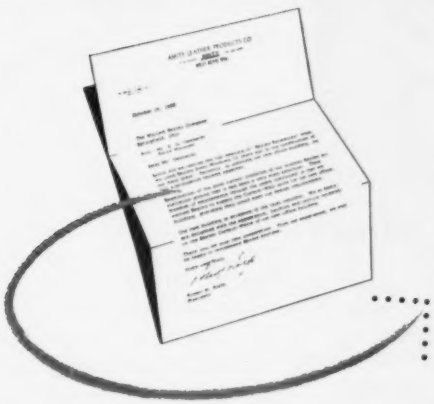
Architect: Charles A. Woehrl, Madison, Wisconsin
Contractor: Winninghoff & Bradley, West Bend, Wisconsin



33 years of reliable performance convinced AMITY LEATHER that their new office building should have a —

Bayley

Curtain-Wall System



• Amity Leather Products Company, West Bend, Wisconsin, manufactures the world-famous Amity and Rolf Lines of personal leather goods. Sponsoring "quality" in every phase of their endeavor for the past forty years, they found in Bayley a supplier with comparable standards of quality and service.

Report in user's own words —

"Little did we realize the full meaning of 'Bayley Reliability' when we used Bayley Steel Windows 33 years ago in the construction of our main plant. Recently, in planning our new office building, its full significance became apparent.

"Examination of the current good condition of our original Bayley installation proved that it had been a very wise selection. Freedom from window maintenance through the years convinced us that we wanted Bayley to supply the Curtain-Wall units for our new office building, providing they could meet our design requirements.

"Our new building is evidence of the final outcome. We at Amity are delighted with the appearance, function and service rendered on the Bayley Curtain-Wall of our new office building.

"Thank you for your fine cooperation. From our experience, we will be happy to recommend Bayley anytime."

The WILLIAM BAYLEY Co.
Springfield, Ohio
Agents in All Principal Cities

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ORIGINATORS • DESIGNERS • MANUFACTURERS • INSTALLERS

state System was so favorable that it justified completion of the system at the earliest possible date. The Bureau of Roads does not favor a stretch-out of the system, but favors its completion on schedule. Their big question is, "Where is the money coming from?"

Organized groups of highway beneficiaries are mapping plans to oppose any legislative effort to place more of the highway cost on them. For this reason, it may be that most members of Congress will favor stretching the program out, rather than levying increased taxes on any class.

The other report, kept secret until it went to the White House and Capitol Hill, was the new cost estimate of completing the Interstate Highway System.

Major General Louis W. Prentiss, executive vice president of the American Road Builders' Association, explained that, under present law, ABC roads have priority. Therefore, on the basis of present cost estimates and estimates of Trust Fund revenue, the seven future apportionments will be insufficient to pay the Federal share of the Interstate System. As a result the general predicts there will be a deficiency of nearly $10 billion. For the first six years of the Interstate program, $11.715 billion was apportioned. To complete the program on schedule, $25.285 billion must be apportioned in the next seven years.

"Simple arithmetic," said General Prentiss, "indicates that it would be necessary to increase Trust Fund revenue by about one and a third billion dollars a year in order to make up the deficiency in a seven-year period. This is a large order. But postponing the decision only makes the job tougher. If we try to make up the deficiency in the last six years of the authorization period, we are faced with an annual increase of more than $1⅓ billion, and if we wait until the last five years, it is almost $2 billion annually." ▲▲

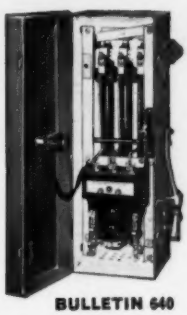
Where Reduced Voltage Motor Starting is Necessary...

Allen-Bradley has the best and most complete answer

No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the *right* starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.

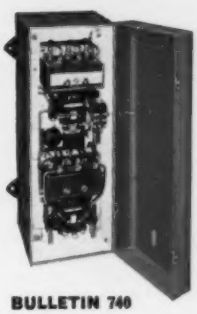
AUTOMATIC AUTOTRANSFORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.

BULLETIN 746



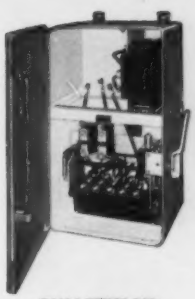
MANUAL STEPLESS RESISTANCE starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.

BULLETIN 640



AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can easily be adjusted to motor and load conditions, giving velvet smooth acceleration.

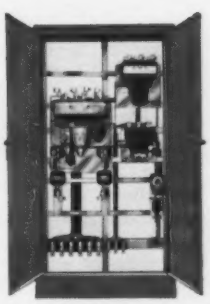
BULLETIN 740



MANUAL AUTO-TRANSFORMER starter for use where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

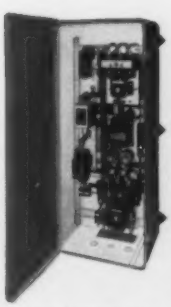
BULLETIN 646

AUTOMATIC MULTIPOINT RESISTANCE starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals adjustable to provide velvet smooth starting.



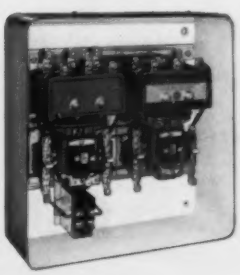
BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company requirement. Eliminates lamp flicker on networks used for power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

3-61-RM

ALLEN-BRADLEY

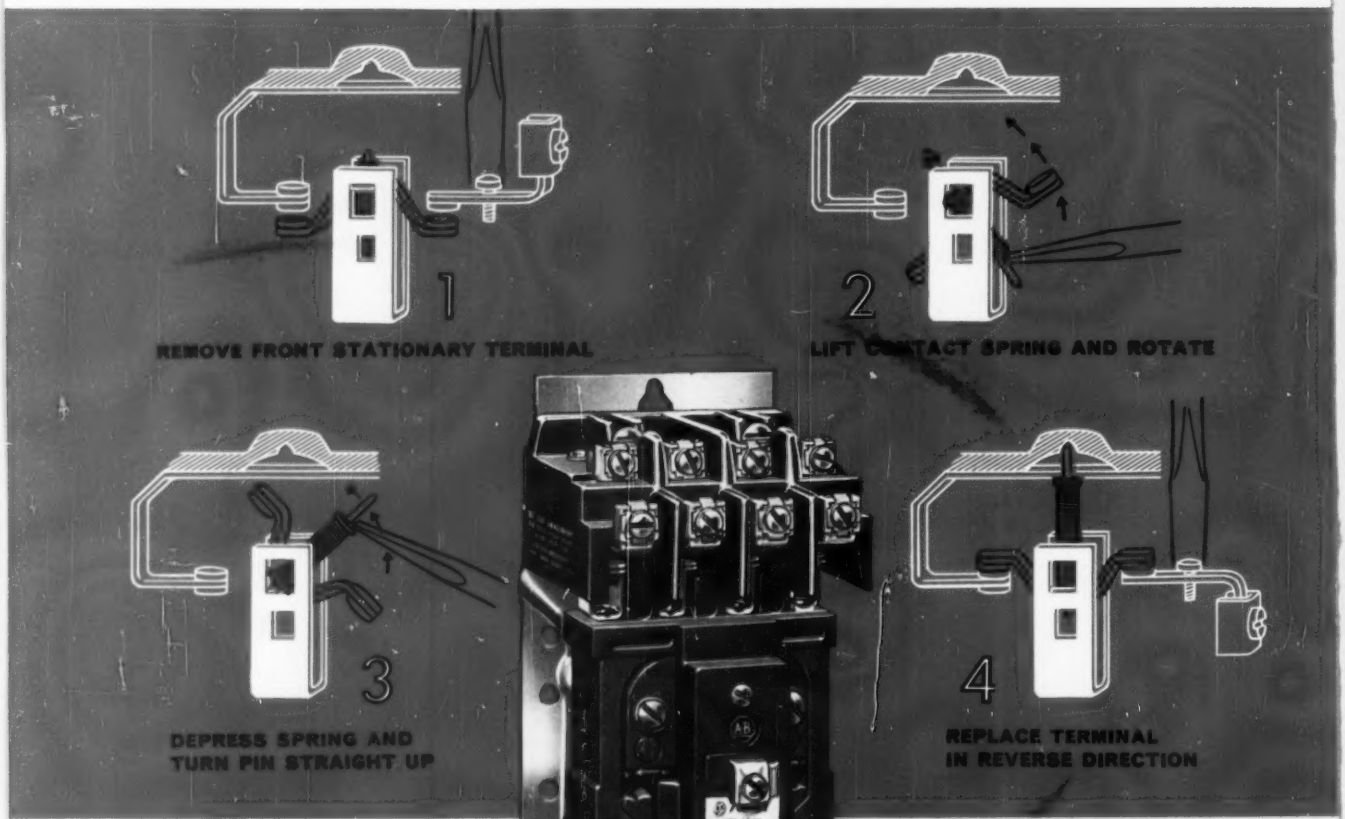
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

Four simple steps to contact changeover

Total time—not more than 60 seconds



Converts from N.O. to N.C. (or vice versa) in 60 SECONDS!

You'll be truly amazed at the ease of converting the contacts on these Allen-Bradley Bulletin 700 Type BR relays. Using only a screwdriver, as shown above, the contacts can be changed from N.O. to N.C. (or vice versa) in four easy steps—that take only *60 seconds!* Such convenient flexibility is a "natural" for reducing relay inventories.

The Type BR relays are built to provide *many millions* of trouble free operations. With the built-in permanent air gap, magnetic sticking is impossible. And the molded coil is impervious to *all* harmful atmospheres. Of course, the double break, silver contacts *never* need attention. If you use relays, there are money savings for you in the Type BR relay line!

AUXILIARY CONTACTS EASILY ADDED

Type BR relays are available with 2, 3, 4, or 6 poles—but as a valuable bonus, one or two fully rated poles can be added to the base of each relay—even in the field. It's a simple addition that takes only moments.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

3 61-RM

DUNHAM-BUSH VARI-VAC DIFFERENTIAL HEATING

the system that's specified and respecified

FOR FUEL ECONOMY

FOR GREATER TENANT COMFORT

FOR LOWER SYSTEM MAINTENANCE

FOR PRECISE CENTRAL CONTROL

VARI-VAC—The sub-atmospheric steam control system. Automatically adjusts steam temperature from 133° to 218°—25" vacuum to 2 lb. pressure—to give greatest comfort and economy of operation with changing outside weather conditions. Effects fuel savings to cut costs up to 40%. Provides minimum room temperature variations and equal steam distribution to all radiators regardless of location and heat demand. Ensures quiet operation and low maintenance.

Send for full details.

Specified and Respecified at University of Oregon

Proved-in-use Vari-Vac is respecified by users, time and time again. At University of Oregon's 330 room new Walton Hall Dormitory, for example, 10 zones of Vari-Vac were recently specified and installed (with Dunham-Bush vacuum pumps, condensate pumps, convectors, valves, traps, strainers). This brings the University's use of Vari-Vac to over 20 zones of control with previous installations in Earl Hall, Music Building, Journalism Building, Oregon Building and Commerce Building.

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FOR ECONOMY... EFFICIENCY... AND PERFORMANCE... SPECIFY

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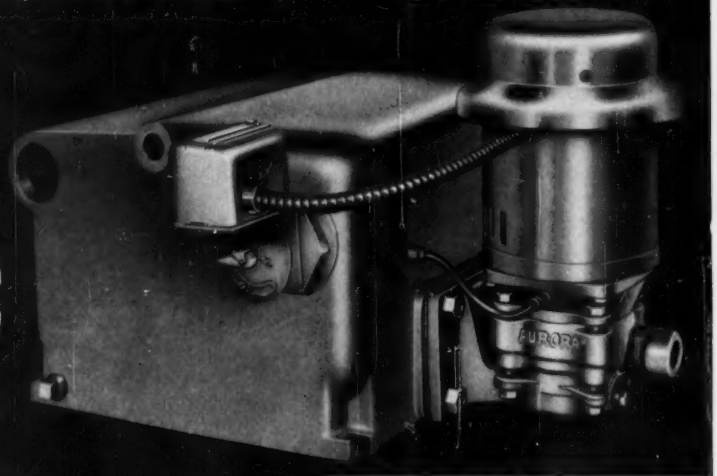
CONDENSATION RETURN UNITS



Capacities to 15000 EDR–To 23 GPM

- Low NPSH ... smooth ultra-quiet operation ... impeller design with curved inlet blade tips that minimize shock loss as the liquid enters the impeller.
- Stainless steel shaft—rigid design eliminates shaft deflection and assures longer life for seal or packing.
- Stainless steel seals ... maximum corrosion resistance ... longer trouble-free life.
- High efficiency ... low horsepower requirement ... less power is needed to provide required delivery ... less initial cost and lower operating expense.
- Utmost compactness—minimum floor space requirements.
- Low return—permits maximum flexibility of application.
- Rugged pump and receiver construction provides maximum long term top performance.
- Complete unit ... ready for installation of lead lines.
- Self venting ... will not vapor lock.
- Combination float switch and alternator optional when desired.
- Simplex or Duplex units.

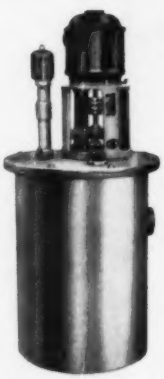
Aurora Pump specialists are always available for consultation on your requirements

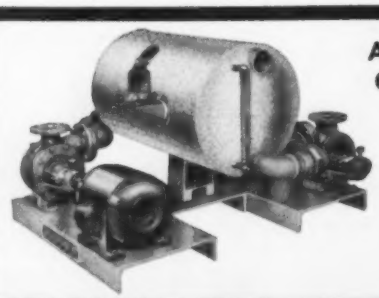
FOR GREATER CAPACITIES ... OR SPECIAL CONDITIONS

VERTICAL UNITS

Capacities to 100,000 EDR 150 GPM

Ideal for applications where return is extremely low or below floor level.





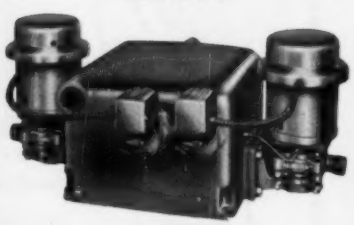
APCO HORIZONTAL UNITS

Capacities to 100,000 EDR 150 GPM

With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS

Capacities to 150,000 EDR 225 GPM



For high capacity or heavy duty applications. Packing Boxes on pumps optional when desired.

AURORA Always PUMPS

AURORA PUMP DIVISION

THE NEW YORK AIR BRAKE COMPANY

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LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

"Quote . . . End Quote"

Engineered Integration

"Yesterday morning came the solemn announcement from the State Pupil Placement Board that it is retaining a *consulting engineer* to determine precisely the distance between Chandler Junior High School, Graves Junior High School, and the home of Wallace Reid Calloway, age 12 . . .

"The longer this segregation fracas continues, the greater the depths of lunacy we seem to reach. In the matter of young Wallace Reid Calloway, the consulting engineer apparently will provide expert testimony on the distances figured four ways — as the crow flies, as a boy walks, as a car drives, and as a bus goes. With these computations before it, the board will decide whether Wallace goes to Chandler or to Graves." — from the *Richmond News-Leader*.

The Professional Draftsman

"All of this raises some difficult questions: should there be, in the typical architectural [engineering] office, a distinction between two types of employees — those who are satisfied with a career in the drafting room and those who have hopes of ultimate practice; should training toward draftsmanship include some other aspects of architecture [engineering], to increase understanding and interest on the part of the draftsman careerist; should there be some supervision, or at least some advice, given to the vocational courses by the professional accredited schools? I don't profess to know the answers to these questions. I do feel that there is nothing wrong with technical education so long as enough understanding of the humanities goes along with it to produce a curious and comprehending citizen. And I certainly agree that drafting-room practices and the professional production of contract documents require particular skills." — from an editorial, *Progressive Architecture*, October 1960.

Competition for Talent

"California carries out nation-wide recruitment campaigns to meet these challenges of size and environment. Through a combination of good pay, job security, and interesting work, the state has been able to hire and hold some of the country's ablest civil engineers.

"Salaries for junior civil engineers start at $530 a month and then range through the next eight grades to state highway engineer at $1707. The entire division, including the state highway engineer, J. C. Womack, is included in civil service.

"One of the greatest attractions of the division for bright CE graduates is the division's reputation for doing all of its own engineering work. A steady source of funds for highway construction make this possible. Most of the country's highway departments farm out design jobs to consultants during peak load periods.

"Promotions are made on the basis of competitive examinations. State policy calls for the appointment to higher positions of those who pass exams instead of hiring persons from outside state service. High level positions are filled almost exclusively from within. The division encourages in-service training and demands professional registration of members above associate engineer." — *Engineering News-Record*, October 13, 1960.

Science vs Business?

"Years ago the most original thinker among American social scientists, the late Thorstein Veblen, gave central importance to the differences in habits of thought between two types of Americans. One type, the business man, Veblen saw preoccupied with a world dominated by financial facts, weighing gains and losses or opportunities and problems in terms of their dollar implications. The other type, the engineer, he saw concerned with the physical facts of the world, with overcoming the tangible obstacles nature puts in the way of achieving man's will. Between these two types of men, Veblen

prophesied gloomily, there must always be discord and friction.

"Few people read Veblen today, but that he was concerned with a real problem is indicated by the study of relationships between business men and scientists just released by Princeton University. The report indicates there is considerable strain and conflict in industrial laboratories because scientists and business men often have different goals, because scientists resent arbitrary orders from superiors who have business rather than scientific competence, and because researchers apparently feel they are not adequately rewarded in terms of pay and status.

"As the Princeton report indicates, the problem is a serious one because the role of scientific and technically trained people in our economy is becoming more important. But despite Veblen's gloom the problem is not insoluble. This is evident from even a superficial study of the substantial number of able scientists and engineers who have also become top-notch business men. But there is a problem here which many business men find difficult because a training in marketing, corporation finance, law, or the like does not make for easy communication with or understanding of men preoccupied with mathematics, physics, chemistry.

"The Princeton report points out some useful steps toward easing the problem. Over the long run, we may suspect, business men will have to learn some mathematics and science to do their jobs, and scientists will have to become more familiar with the economic facts of life as expressed in the dollar amounts in balance sheets and profit and loss statements." — editorial in *The New York Times*, October 18, 1960.

On Civic Leadership

"It is natural for a professional man to command the respect of his friends and neighbors. Civic leadership frequently goes hand in hand with professional advancement. Many successful engineers are rendering valuable services on local or state boards of education or on advisory civic committees. Others are serving on governing bodies. Some engineers are among this country's outstanding statesmen. To follow in their footsteps you should begin by volunteering for some service during the first few years after graduation.

"Finally, when you have made your own place in your new environment, you are urged to serve as a counselor and guide to other young engineers who may follow you into the same community." — from *Citizenship and Participation in Public Affairs*, a brochure published by Engineers' Council for Professional Development.

Computers Can't Say "Maybe!"

"The man and the computer did not work well together when the machine was given any significant

unbiased recommendations for any heavy lifting job because...

AMERICAN 150-ton intake gantry crane on the Rocky Reach Dam, specified by Stone & Webster Co., Boston, consulting engineers on the project.

at American Hoist & Derrick Company we produce *all* basic types of cranes and special materials-handling equipment: bulk unloaders, gantry cranes, revolver cranes, locomotive cranes, crawler and rubber-tired cranes, and a wide variety of specially-engineered products. This important fact enables us to be completely flexible in our thinking... and in our recommendations.

Over the years, we have cooperated with consulting engineers on *hundreds* of specialized materials-handling installations... of all types, sizes, and capacities. Don't you agree that this experience — and freedom to make unbiased recommendations — can be of value to you and your clients?

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part in the decision-making. For one thing, the man learned through experience; the computer did not. For another, the man could often anticipate the 'enemy's' moves; the computer could not. The man could make decisions on the basis of patterns or groups of attackers; the computer was programmed to treat each object separately.

"Probably the most interesting conclusion is that the man is far more flexible than the machine. Compared to a computer, a man's ability to make absolute decisions and do fast computations is relatively poor. But in answer to the question of whether or not he could intercept before a raid reached the target, he could gamble in some circumstances and answer 'maybe;' the machine could only answer 'yes' or 'no.' Thus the man might attempt an interception, sometimes with successful results, which initially appeared to be so unlikely that the computer would not even try.

"Man's ability to weigh odds and to gamble gives him at present an advantage over the computer in this sort of test. Computers of the future will have to have the word 'maybe' added to their vocabularies." — from *Engineering Outlook*, a bulletin of the University of Illinois.

How the Bureau Stands

"It is not difficult to obtain information on the cost of public engineering organizations. The difficulty lies in terminology of cost keeping methods and the scope of work which is included, because of the broad nature of the terms 'engineering' and 'design.' Contracts for engineering services with Government agencies can never encompass the entire scope of engineering activity of Federal agencies, the cost of which the agency must charge to the project. If a study of Government engineering costs were undertaken, there is no assurance that the results obtained would be conclusive or show costs directly comparable with those furnished through surveys and reports of engineering societies.

"Do not read into my words any lack of concern over engineering costs in the Bureau of Reclamation. My good friend and long-suffering colleague here, our Assistant Commissioner and Chief Engineer, Grant Bloodgood, who heads our Denver Office, can attest to my parsimonious nature in dealing with Bureau funds. Irrespective of criticism of engineering societies, or that of Congressional Committees, we are extremely cost-minded and insist upon getting the greatest production from our engineers and other employees at the lowest cost to the taxpayer.

"With respect to the employment of private engineering firms and consultants on Reclamation work, I believe that the Bureau's practice is consistent with the National Society of Professional Engi-

For trouble-free underground hot pipe insulation specify GILSULATE® with Engineer-Supervised Installation

Every engineer charged with the responsibility of designing a central heating system to heat all buildings of a college, institution or industrial plant knows the money-saving advantages of such a system if properly planned. But he is aware that planning the underground piping can involve many problems, for the system must provide proper insulation and also protect pipes against corrosion, chemical and electrical attack.

The easy, one-step solution to many of the problems of underground hot pipe insulation is to call the GILSULATE distributor in your area: first, for the superior quality of the insulation material he sells and, secondly, for the excellent service he has to offer.

GILSULATE is a naturally-occurring mineral which, because of its unique chemical and physical properties, is chemically neutral in all soils, dielectric, impervious to mold, rodents and plant growth, and is water-resistant. Its thermal efficiency, low installation cost and long service life are supported by extensive laboratory and field research, and also by years of successful use in thousands of installations throughout the world.

Service that saves time and trouble—It is as important to our reputation that GILSULATE be used properly as it is for the engineer to assure his customer of an efficient, economical installation. Our distributors' experienced mechanical engineers will work with you in preparing underground piping plans, checking soil conditions and arranging for supervision of the installation work. And, without any cost to you, plans and specifications will be checked by American Gilsonite's Engineering Department.

Full-time engineer supervision of installations—Every GILSULATE installation of 30 tons or more is supervised by an American Gilsonite Company field service representative who stays on the job until it is completed. Smaller jobs are inspected by the distributor's engineer. This is a guarantee to everyone concerned...owner, architect, engineer, mechanical contractor and materials supplier...that every step of the job will be exactly to specifications.

Without obligation, we will be pleased to send you technical information on GILSULATE insulation so you can evaluate the merits of this low-cost, poured-in-place material. We will also put your name on the mailing list to receive free copies of PIPE INSULATION NEWS.

Once you have learned the merits of GILSULATE, we feel certain you will want to write your "specs" to assure the use of GILSULATE...*with engineer-supervised installation.*

FACTS ABOUT GILSULATE

1. **Easy-to-use**—just pour, shovelpoint and tamp...pipe heat does the rest.
2. **Forms protection against heat loss** and all hazards commonly encountered by buried hot pipes.
3. **Needs no housing or mechanical sheaths:** no mixing, special handling or equipment.
4. **Only needs normal pipe spacing:** for multiple pipe or cramped conditions.
5. **Four types available:**
   Type A for 220-300° F. temp. range
   Type B for 300-365° F. temp. range
   Type Special B for 365-420° F. temp. range
   Type C for 420-520° F. temp. range

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neers. We have on many occasions utilized private consultant engineer services on our construction work where this has been in the best interest of the public. We plan to continue this practice wherever such engineering services can be used effectively to augment or supplement the work of our engineering staff.

"For instance, in the investigation and review of the sites and designs for major structures, our policy is to appoint boards of prominent independent consultants to assist in reaching final conclusions on the complex engineering problems involved. In other cases involving structures or works which are beyond the capacity of our staff or involve some unique or specialized field of engineering we call on qualified engineering firms or consultants to perform the work." — Address by U. S. Commissioner of Reclamation Floyd E. Dominy at a luncheon session during the fall professional meeting of the *National Society of Professional Engineers*, Denver, Colorado, October, 1960.

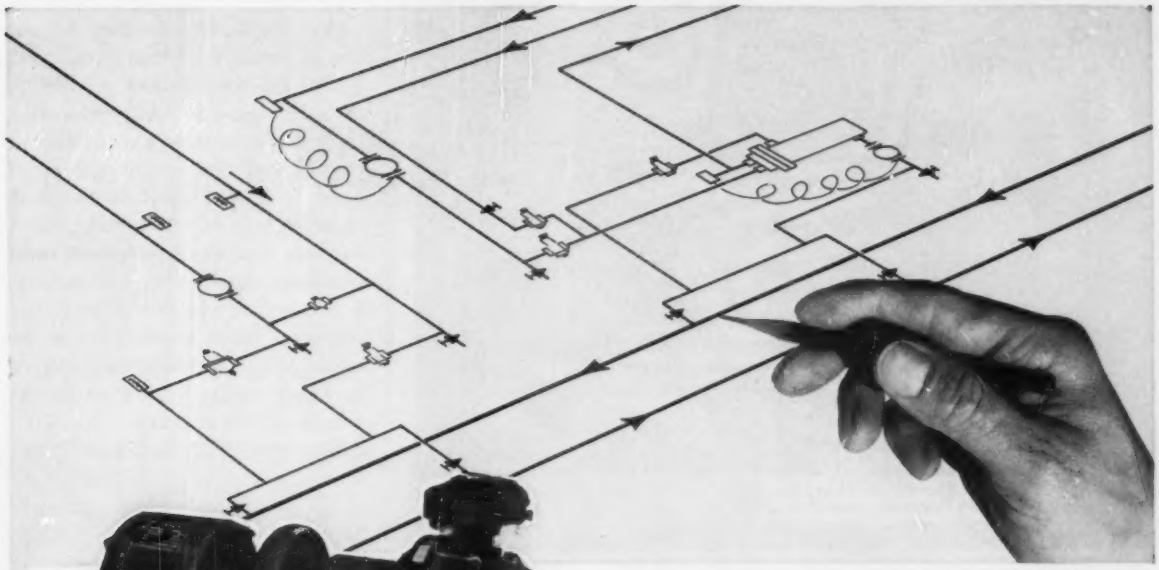
Russia . . . the Analytical

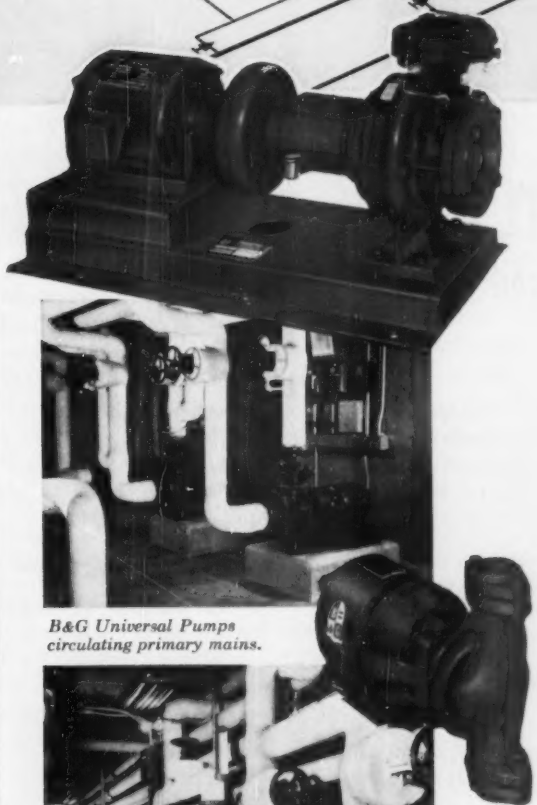
"We spent four weeks recently on an exchange mission to the USSR, for the basic purpose of studying the utilization of engineers and engineering technicians throughout the Soviet Union. The itinerary covered six cities, and visits were made to 13 technical institutes, three technicums, and five industrial enterprises.

"Some of the more important observations which the members of the mission came back with were:

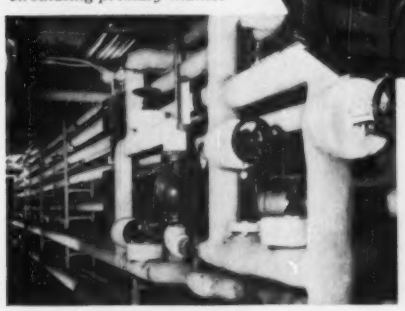
¶ That there is a deep and serious determination on the part of all the Soviet people to better themselves through education, as this is the path toward higher financial and social standing.

¶ That the engineering establishments visited were certainly providing good fundamental engineering backgrounds, plus practical industrial training in a narrow spe-





B&G Universal Pumps circulating primary mains.



B&G Booster Pumps supplying individual heating zones.

Primary and secondary pumping as developed by B&G® cuts heating system operating costs

Where multiple buildings or multiple zones within a building are to be heated with circulated water, *Primary and Secondary Pumping*, as conceived and developed by Bell & Gossett engineers, both reduces pump horsepower and saves fuel by improving heat control.

A typical system consists of a primary main continuously circulated by a B&G Universal Pump, with smaller B&G Booster Pumps drawing on the main to supply separate heating zones. Each zone pump is under individual thermostat control, so that each zone can be supplied with exactly the amount of heat required by its function or exposure.

Write for free booklet which gives detailed information on this more efficient, more economical method of heating with circulated water.

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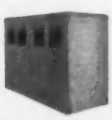
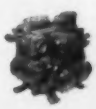


Package Liquid Coolers



Refrigeration Compressors

Marlow Pumps

Heat Exchangers

Oil-less Air Compressors

cialty, the latter obtained by the use of actual industrial equipment.

¶ That the total annual production of both engineers and engineering technicians is well above that of the United States. On the other hand, due probably to the lack of a large supply of highly skilled workers and the consequent need for closer supervision and control, it is customary in the USSR to use engineers much lower down in the management scale and in positions to which we would not assign engineers in this country.

¶ That industry plays a very important part in the training, guidance, and examination of both engineering students and industrial workers in all categories.

¶ That women engineers and technicians are employed in a wide range of technical positions, possibly some 30% of the total, although a smaller percentage reach top positions.

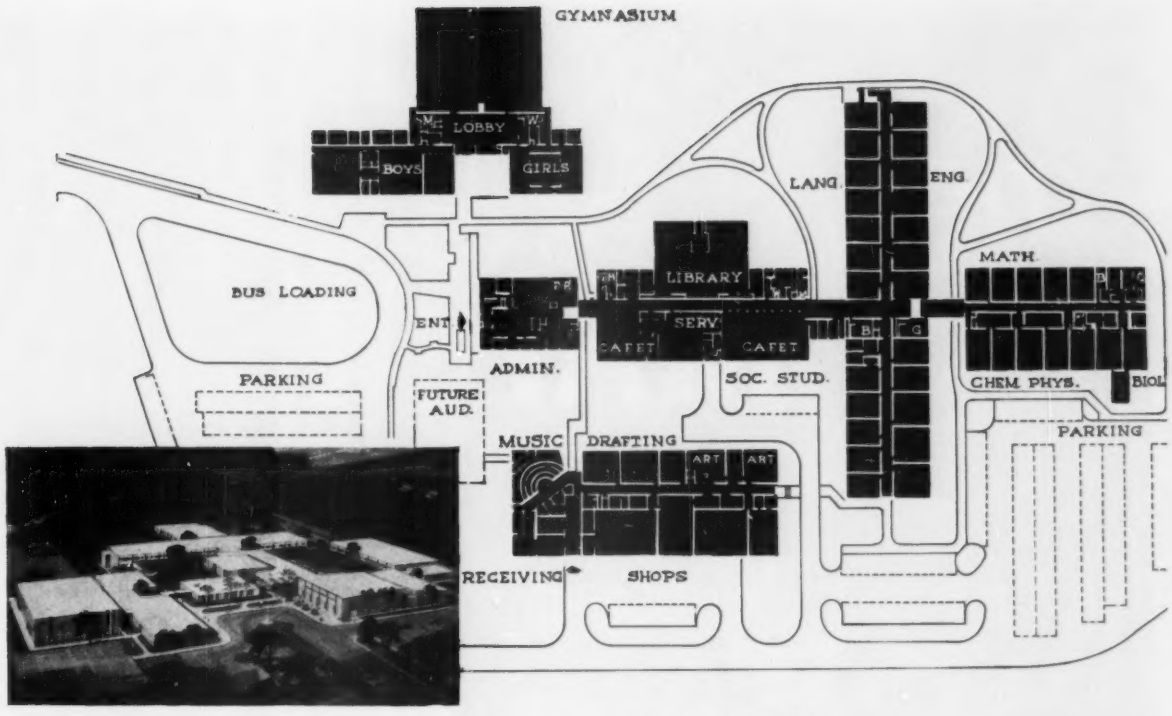
¶ That research, or more properly development, is widely supported by industrial enterprises through research contracts with the Institutes, through the operation of their own separately financed research institutes, and research staffs." — Walter E. Lobo, in *Your Consultant,* October, 1960.

Government Engineering Again

"While many state highway departments have to justify the amounts they pay private consultants for design work, California's Division of Highways last week had to explain why it does all its own design work and never engages consultants.

"Critics of the division have claimed that its engineering costs are running 24.1% of road costs, whereas consultants could do the work at less than 5%.

"The division estimate of consultants costs is almost 50% above the average fees reported early this year by the National Society of Professional Engineers. The NSPE figure was 3.55% of construction costs." — *Engineering News-Record,* October 13, 1960. ▲▲

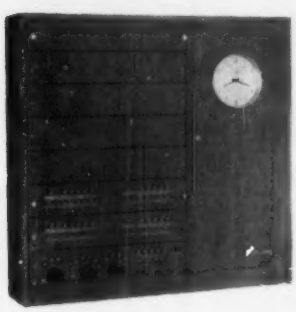


PLANNING THE NEW SCHOOL

This unusual new high school in Darien, Conn. has a present enrollment of 810 pupils, yet can easily be expanded to accommodate the 1200 to 1300 student population expected within five years. Architects Ketchum & Sharp, consulting engineers Cosentini Associates, and a hard working school building committee planned wisely for both present and future while keeping square foot costs below those of Darien schools built in 1948 and 1951.

General Contractor – Deering Construction Company

Electrical Contractor – Wilton Electric, Inc.



AT DARIEN . . . the need for an efficient Electronic Time Control and Program system, free of operation and maintenance problems lead to the selection of Stromberg. Dependably correct clocks and signals are assured by the precision Master Time Control which automatically supervises secondary units hourly, as well as at 12 hour intervals – *and* program signals are immediately corrected following a power failure. These synchronizing signals operate on ordinary lighting circuits – require no special wiring; all correction cycles are completed in only 60 seconds. Stromberg's exclusive seven-channel transmitter may be arranged with one frequency for clock supervision and the other six for program signals; this program unit will handle as many as 1440 signals daily on each circuit and is fully modular in that channels can be added as needed without new wiring costs.

Stromberg Automatic Remote Control Center, in any standard Stromberg installation, will control all clocks and audible signals, as well as automatically program the "on-off" of lighting centers, heating and air conditioning and ventilating for optimum cost efficiency. *And* – manual controls permit temporary changes at any time without interference with the basic schedule.

Stromberg offers installation and maintenance service throughout U.S.A. and Canada.

A complete catalog – TIME AND SIGNAL EQUIPMENT – prepared for Architects and Engineers – is yours for the asking.

STROMBERG DIVISION

GENERAL TIME CORPORATION

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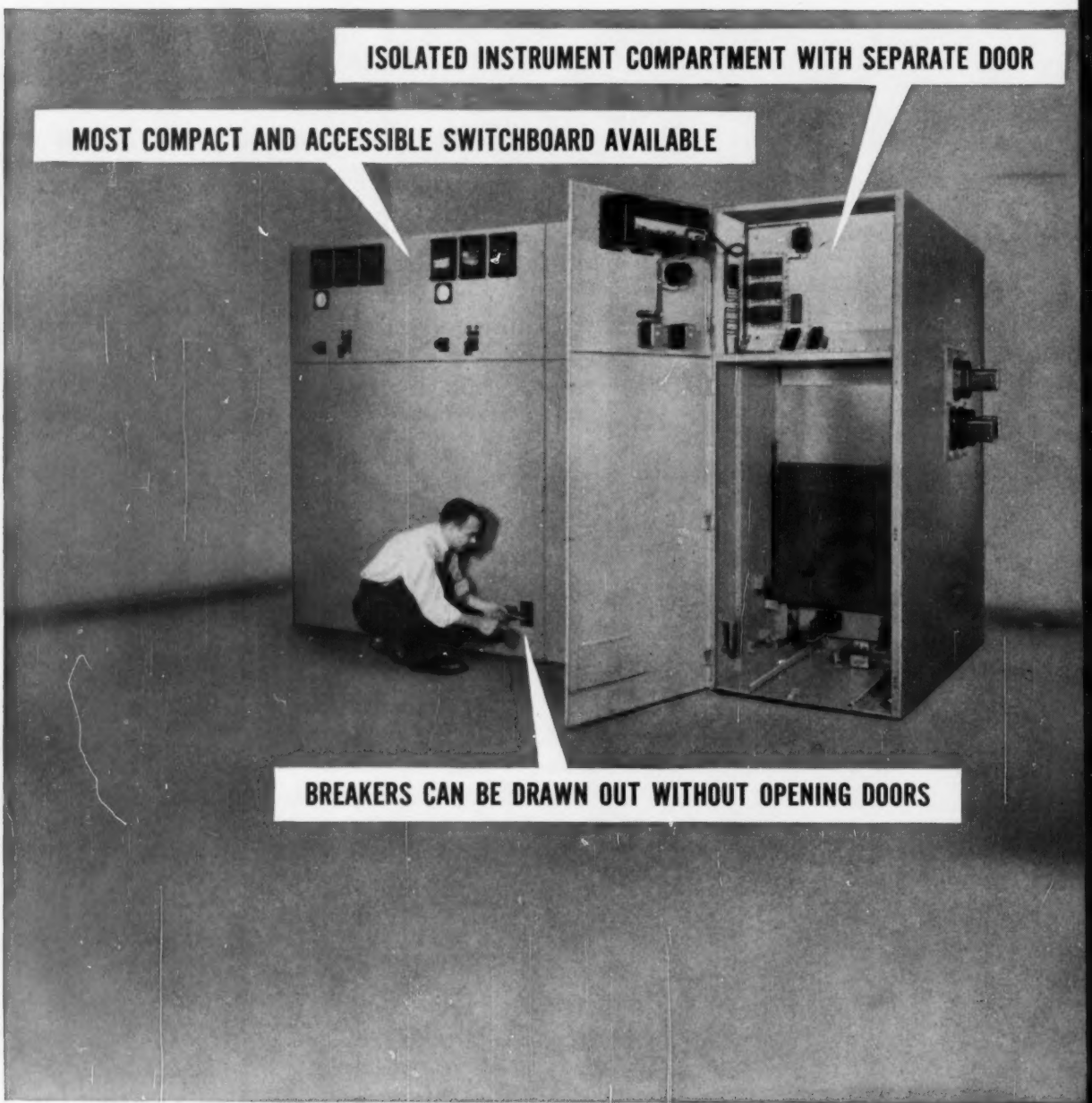
New *SpaceMaker* control is the first completely new high-voltage motor controller in more than a decade. It is the first two-high, 2 to 5 kv control center design — so compact that two complete controllers require no more floor space or head room than one conventional unit. It is also the first controller in its voltage class to feature complete drawout construction for unprecedented safety and accessibility.

Downtime for inspection and maintenance is reduced to an absolute minimum. The contactor carriage is quickly racked in and out of connect position by means of a ratchet door handle. One man can easily roll the carriage out of the control enclosure. No flexible leads or bolted connections are involved. Arc chutes and barriers simply lift out, and pole pieces rotate to completely expose the entire contact structure. Other inspection and maintenance procedures are equally simplified.

And, all inspection and maintenance are accomplished in complete safety without the need for de-energizing the bus. It is impossible to come in contact with "live" parts. Racking of the carriage is done with the metal door in closed position. Insulated shutters automatically isolate live line connections when the contactor is racked out.

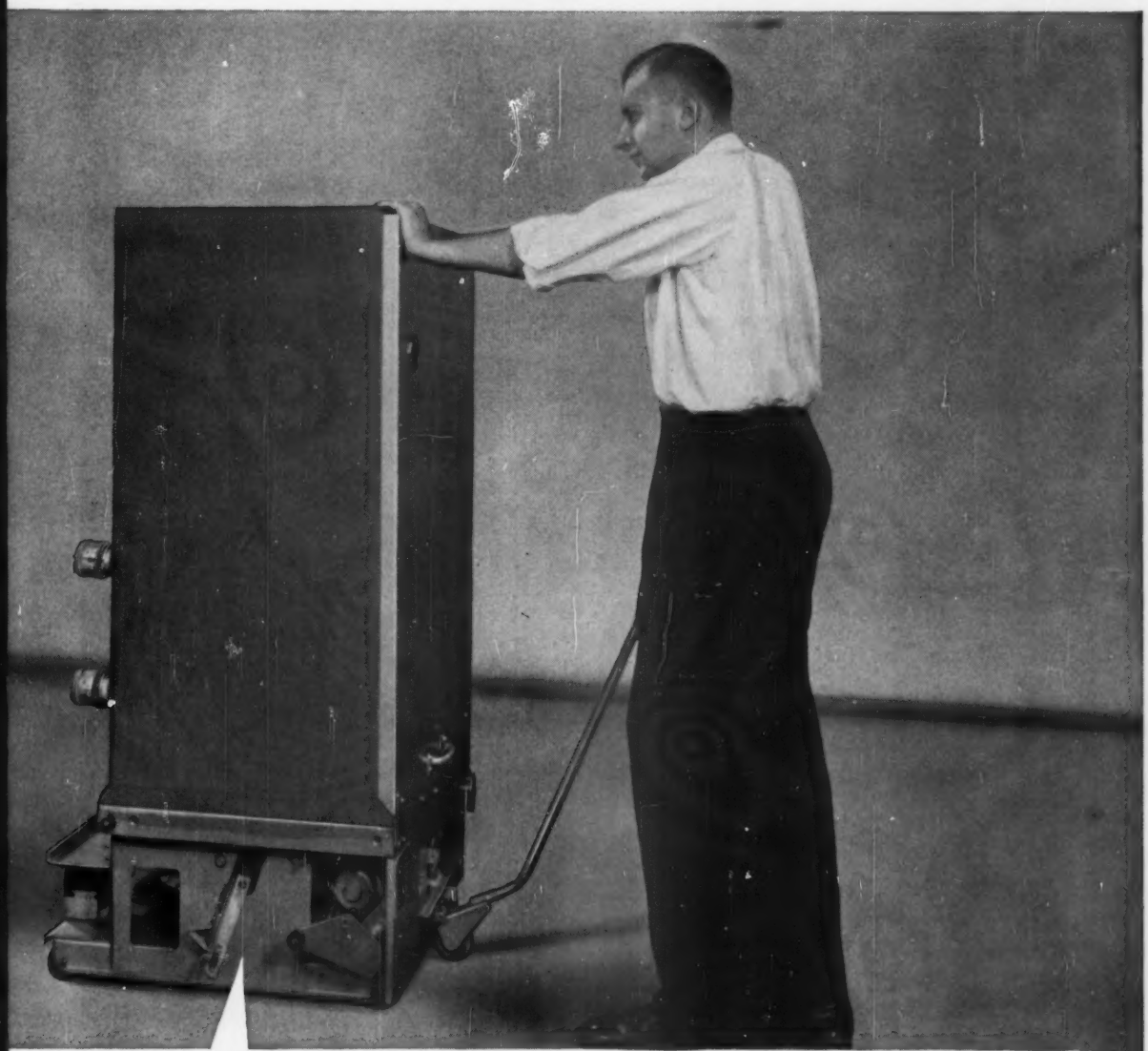


NOW YOU CAN ALWAYS,

have fast, safe operation of your

Stored energy closing is just one of the many big progressive steps forward you will find in this all-new I-T-E 13.8 kv switchgear. So is the separate, isolated instrument compartment . . . and the closed door drawout . . . and the more compact switchboard! Here is new safety, new long life potential, and new greater assurance of uninterrupted service.

One man can handle the entire maintenance job. The breaker is not only smaller, it's significantly lighter—the result of using new, more modern materials. Phase barriers may be easily removed by one man. Arc chutes can be tilted back. The breaker frame may even be flipped over without assistance. With the huge cable makeup area and the easily accessible bus, this is truly the easiest to maintain 13.8 kv switchgear yet.



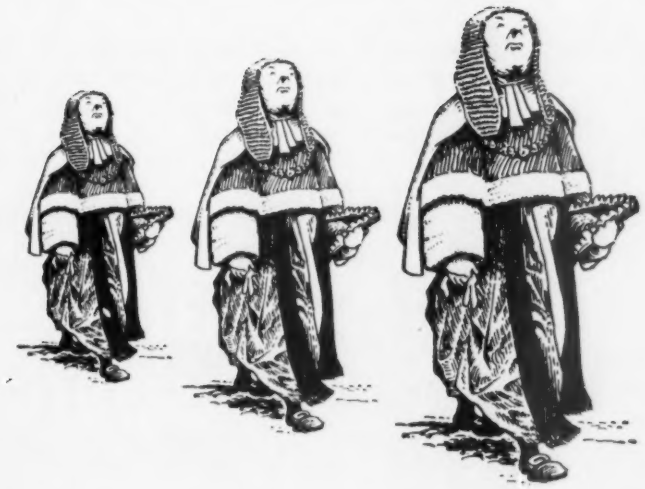
DESIGNED EXCLUSIVELY FOR STORED ENERGY

ALWAYS, IN ALL WAYS

13.8 kv circuit breakers every time

If you are about to specify new 13.8 kv switchgear, make sure you get all these I-T-E advantages. And right now send for illustrated Bulletin 2800-2B, with complete details. Or contact your nearby I-T-E sales office. I-T-E Circuit Breaker Company, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY



The Legal Aspect

DR. MELVIN NORD
Registered Engineer
Attorney at Law

Third Party Negligence

Contract and Tort Liability

IN MOST STATES the basic difference between tort liability for fraud and contractual liability for breach of warranty is that the former requires an intention to do wrong, while the latter requires neither negligence nor intention and results in strict or absolute liability regardless of fault.

An even more important difference between tort liability and contractual liability is that privity of contract is vital if the liability is in contract but not if the liability is in tort. Since tort liability arises out of a duty placed on someone by operation of law rather than out of the promise of performance to a definite person or persons, the question in tort liability is not whether there was privity of contract, but simply to whom the duty is owing as a matter of law. Since the duty, in tort cases, arises by operation of general rules of law, it is always owing to persons generally or to persons falling in certain general categories, rather than to specifically identified persons, as in contract cases. Thus there is an inherent tendency for tort liability to extend to a wider circle of persons.

Tort Aspect of Warranty

Warranties in the sale of goods are regarded as contractual in nature, so that privity of contract is required in order to maintain an action. However, they also have some relationship to tort law. Part of this is because not all warranties relating to the sale of goods are promissory in nature. A statement that the goods to be delivered in the future will correspond in quality to a certain sample is clearly promissory in nature, but a representation that the goods already selected do in fact correspond in quality to the sample is not really promissory. It is a representation of the presently existing state of affairs; a promise looks only to the future. Nevertheless, such a representation (relating to the quality of the goods sold) is also considered a warranty. In essence, it is as if it were a promise or undertaking to make good on any discrepancy between what was represented and the actual fact. If this representation proves false, there may be a contractual action for breach of warranty.

On the other hand, if there is an intentional misrepresentation, the normal remedy is in tort, for fraud and deceit. (Tort liability occurs when there is a breach of a duty arising by operation of law, rather than out of a promise. For example, the law places a duty on every person not to defraud any other person by deceptive representations of fact.) Outside of the area of sales of goods, a misrepresentation of fact is not generally regarded as resulting in liability for breach of contract. In the law of sales of goods, however, a misrepresentation of fact may sometimes lead to an option to maintain an action, either in tort, under a fraud and deceit theory, or in contract, under a breach of warranty theory.

So a warranty frequently is not really promissory at all, in which case it clearly has a tort aspect. This is particularly true in the most important warranty cases, where the warranty is not expressed but implied, that is, placed on a party by virtue of a rule of law rather than by his own act. In such a case, although the warranty may be treated at law as if it were contractual in nature, in reality it is in the nature of tort liability.

Establishing Liability

As cases arise in which plaintiffs, in the position of third persons, try to establish liability against defendants, the effort is either to establish contract liability by broadening the definition of privity of contract or to establish the existence of a duty owing to the plaintiff irrespective of lack of privity of contract. Both of these are now at work in the law of sales of goods, and the law in this region is being stretched to fit modern life.

In some states, recent cases hold that a warranty runs with the

goods if the defendant has been guilty of a tort such as negligence or fraud. The attitude of the courts has been that there is no point in being fussy about whether the plaintiff wins on the warranty theory or on the tort theory, since he certainly must win one way or the other. While this is true in the individual case, the net result is to break down the privity concept in warranty cases, since other judges seize on these decisions to show that privity is an outworn concept in warranty cases. While this may not seem to be of any real significance, it is actually important for several reasons:

¶ It obscures the conceptual difference between tort and contract liability, thereby making this entire area of law a fuzzy region in which analysis and prediction are impossible. Cases can only be decided by a law-making process, not by a law-interpretation process.

¶ It accidentally eliminates the requirement of intention to deceive in fraud and deceit cases, and the requirement of lack of due care in negligence cases, and substitutes strict liability.

¶ It accidentally eliminates the defense of contributory negligence in negligence cases.

¶ It accidentally increases the statute of limitations period for tort actions (from three years for a tort action to six years for a contract action).

Extending Liability

This privity stretching tendency in warranty seems to change breach of warranty in sale of goods cases from a contract liability to a tort liability, without adhering to the restrictions on tort cases. However, it does not really go this far; the liability is not generally extended to persons at large, only to subsequent owners of the goods. But this limitation frequently is a hindrance in trying to achieve justice in a particular case. If a manufacturer sells unwholesome food to a dealer, and the dealer sells it to a customer, in many states the customer now has a breach of warranty action directly against the manufacturer. The question which remains is whether the customer's social guest would have a breach of warranty action against either the manufacturer or the dealer.

In a proper case involving dangerous goods (such as exploding pop-bottles), it has been held that the basis of so-called breach of warranty cases in these areas is strict liability in tort, i.e., that the action is in no sense of the word a contract action, but rather is one founded entirely on tort principles. Therefore it does not preclude strangers from bringing suit. This is at least an effort to make sense out of the law in this area, as well as to achieve justice. By calling this a strict liability tort, however, the court eliminates the requirement of negligence which other

BOWATERS UTILIZES BY-PRODUCT WASTE AS FUEL

At Bowaters Carolina Corporation, Detroit RotoGrate Stoker, with 6 Detroit air swept spout refuse distributor feeders, installed under Babcock and Wilcox 2 drum single pass steam generator. Steam is produced at 850 psig, 900° F-T.T. Feedwater temperature 300° F. Combustion air temperature is 350° F.

Bowaters Carolina Corporation's new plant at Catawba, South Carolina uses a Detroit RotoGrate Stoker to burn bark refuse under a steam boiler. The installation is designed to produce 200,000 pounds of steam per hour when burning bark alone.

Costly waste disposal measures, which in years past were common to pulp mill operation, have been eliminated.

Provision is made for future firing of coal either in conjunction with bark or separately, and 275,000 pounds of steam will be produced with this combination. Peaks of 300,000 pounds of steam are anticipated.

Oil and gas burners in the furnace walls are presently used for auxiliary firing if refuse fuel is not available in sufficient quantity to supply the demand for steam.

Versatile in their ability to burn a broad variety of fuels . . .

DETROIT ROTOGRATE STOKERS

. . . have an established reputation for efficient performance.

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DETROIT STOKERS COST LESS: Cost equals initial investment plus upkeep plus production losses due to equipment outage. *The total is less with Detroit.*

DETROIT STOKER COMPANY

DIVISION OF UNITED INDUSTRIAL CORPORATION

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courts have insisted on in similar cases. When, in order to eliminate privity, a court recognizes the underlying tort aspect of a warranty case, it tends to retain the strict liability aspects of the warranty action, even where this is not necessary nor consonant with general principles of tort law.

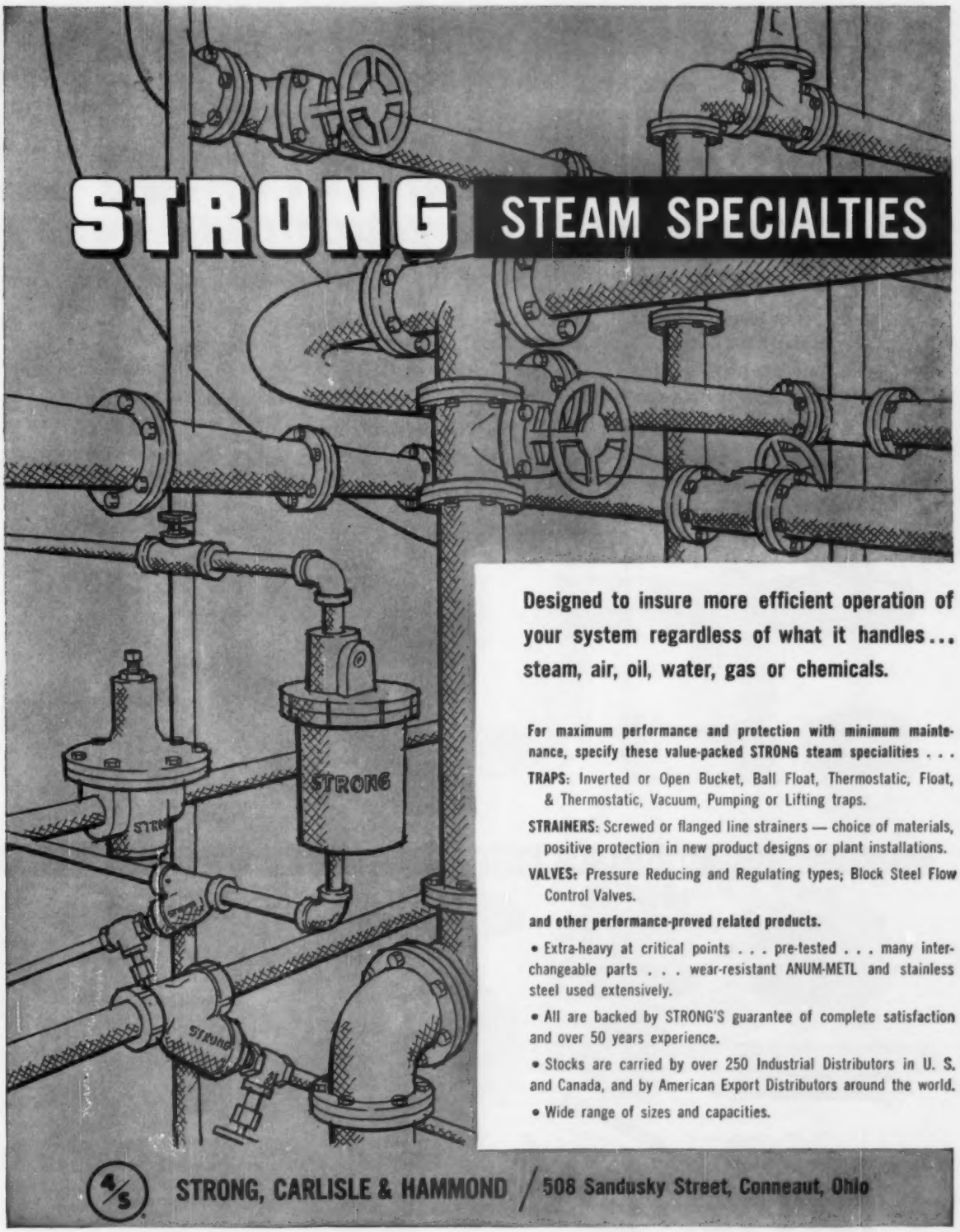
Service Contracts

Somewhat similar problems have arisen in connection with contracts to provide services. If the suit is for breach of contract, privity of contract is required, and this automatically precludes third persons from maintaining the suit. If the suit is in tort, third persons are not necessarily precluded, but the elements of proof are different, the statute of limitations is shorter, and there remains the question of whether the duty runs to them.

If the contractor fails to perform at all, it is clear that no third person can complain on either a tort theory or a contract theory, even though he would have received some incidental benefit from the work if it had been performed. There was no intention to benefit him directly, nor is he a party to the contract, nor an assignee; he lacks privity of contract. It may be true that the contractor had a duty of care, on account of the existence of the contract, and that he may negligently have failed to fulfill this duty, but the duty to do the work existed only because of his promise, and thus ran only to persons in privity. There has been no tort.

Conversely, if the contractor starts to perform the work, and does it in a negligent manner, several consequences follow. The promised party can maintain an action for breach of contract, since the duty of care arose out of the contract. Alternatively, he can maintain an action in tort for negligence, in accordance with general principles. According to a basic principle of negligence law, if a person engages in an activity which may cause injury to someone else unless performed with reasonable care, he has a duty, arising by operation of law, to exercise reasonable care. The first question in such cases is to whom the duty of care extends. All courts agree that it extends to any foreseeable plaintiff, that is, to any person whom it is reasonably foreseeable may be injured by the activity if not carefully performed. Obviously, this includes all persons who are in privity of contract with the defendant, since the whole object of the performance is to benefit them. This does not necessarily mean that the duty extends only to such persons, since there may be other foreseeable plaintiffs. In order to determine whether or not the tort duty runs to a particular plaintiff, therefore, it is a sufficient but not a necessary condition that he be in privity of contract. ▲▲

(Next month: Tort Liability.)



Designed to insure more efficient operation of your system regardless of what it handles... steam, air, oil, water, gas or chemicals.

For maximum performance and protection with minimum maintenance, specify these value-packed STRONG steam specialities . . .

TRAPS: Inverted or Open Bucket, Ball Float, Thermostatic, Float, & Thermostatic, Vacuum, Pumping or Lifting traps.

STRAINERS: Screwed or flanged line strainers — choice of materials, positive protection in new product designs or plant installations.

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and other performance-proved related products.

- Extra-heavy at critical points . . . pre-tested . . . many interchangeable parts . . . wear-resistant ANUM-METL and stainless steel used extensively.
- All are backed by STRONG'S guarantee of complete satisfaction and over 50 years experience.
- Stocks are carried by over 250 Industrial Distributors in U. S. and Canada, and by American Export Distributors around the world.
- Wide range of sizes and capacities.

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FOR FAST AND RELIABLE SERVICE... Buy from your local Industrial Distributor

KILLARK...THE MOST COMPLETE of ALUMINUM FITTINGS and

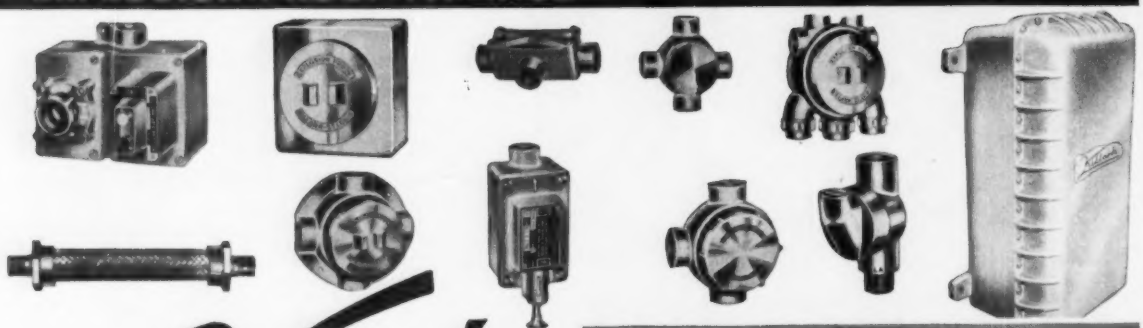
One source for all your fitting needs

FEATURING . . .

- Durable, lightweight all-aluminum construction
- Rustproof, corrosion-proof
- For standard and hazardous locations
- Fast, dependable deliveries from 19 strategic warehouse locations
- Backed by over 40 years' experience

STANDARD LOCATIONS

EXPLOSION-PROOF FITTINGS



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KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

VANDEVENTER AND EASTON AVE. • ST. LOUIS 13, MO.

and FASTEST-EXPANDING LINE FIXTURES IN AMERICA!

SWITCH RACK EQUIPMENT—EXPLOSION & WEATHERPROOF

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Explosion-Proof

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LIGHTING FIXTURES—SPECIAL LOCATIONS

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KILLARK ELECTRIC MFG. CO.
Vandeventer & Easton, St. Louis 13, Mo.
Gentlemen: Please send me following material:

- ☐ Explosion-Proof Fittings Catalog No. 13
- ☐ Condensed Catalog No. 59
- ☐ Vapor-Tight Light Fixtures Catalog No. 12
- ☐ Circuit Breakers Catalog No. 17

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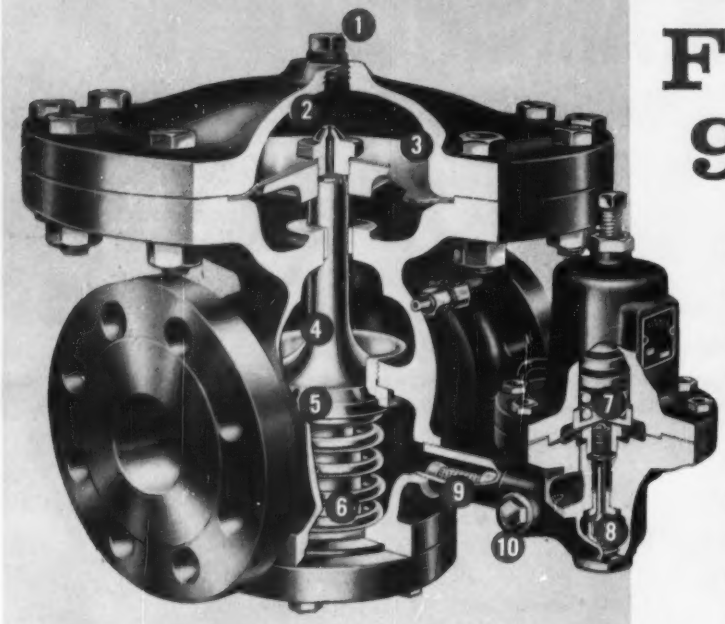
SOLD THROUGH LEADING DISTRIBUTORS' WAREHOUSE STOCKS IN NINETEEN CITIES

No Clogged Orifices — No Sticky Valves
No Diaphragm Rupture Install the Improved



FISHER 92B STEAM REDUCING VALVE

1. Pipe plug directly over bleed orifice for cleaning ease
2. Bleed orifice designed to reduce plugging
3. Stainless steel diaphragms for maximum strength
4. One-piece stainless steel inner valve and stem
5. Stainless steel seat ground at 60° angle
6. Inconel valve spring resists corrosion
7. Bellows seal eliminates pilot valve sticking
8. Pilot valve seat of hardened stainless steel
9. Removable strainer to protect pilot valve seat
10. Pipe plug for easy strainer flushing

Now Available in Tough High Strength Nodular Iron For Pressures Up To 300 psi

Here's a pilot operated, pressure reducing valve designed to minimize problems inherent in steam service. Fisher 92B is a completely self-contained unit. It is especially desirable for use where air or gas is not available as an operating medium.

Once installed the 92B is easily maintained. The bleed orifice can be cleaned by removing one fitting.

PRESSURE RATINGS AND SIZES

Body Material	Working Pressures	End Connections	Body Sizes
IRON	250 psi @ 410°F	Screwed	½"–2"
	125 psi @ 380°F	125 lb. flgd.	1½"–6"
	250 psi @ 410°F	250 lb. flgd.	1½"–6"
NODULAR IRON	300 psi @ 450°F	Screwed	½"–2"
	150 psi @ 366°F	150 lb. flgd.	1¼"–3"
	300 psi @ 450°F	300 lb. flgd.	1¼"–3"

The inner valve, seat ring and main spring can all be reached through the blind flange. The 92B reduces inlet pressures up to 300 psi down to outlet pressures from 2 to 150 psi. Precision construction of the pilot gives the valve exceptionally close accuracy.

NODULAR IRON CONSTRUCTION

The 92B is now available in Type 60-45-15 Nodular (ductile) iron (ASTM No. A395-56T). This extremely tough, high strength iron can be cast into the intricate shapes of the 92B and still retain full strength and pressure tightness. In addition Nodular iron resists corrosion, extreme heat and thermal shock. Precision machining plus rugged Nodular iron construction adds up to this notably improved version of the time-tested 92B.

WRITE TODAY FOR FULL DETAILS
ASK FOR BULLETIN D-92B

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD...CHANCES ARE IT'S CONTROLLED BY...

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT COMPANY, CORAOPOLIS, PA.

FISHER

SINCE 1880

The High Spots

CEC Insignia

The Consulting Engineers Council reports that its new insignia – a three pointed star set in a circle – is gaining in popularity and use within the profession. The insignia, which was adopted at the CEC annual meeting last May in Oregon, was designed for use on stationary, publications, telephone listings, and banners. It may not, however, be used on drawings.

The designer of the emblem, W. O. Stevens, of W. O. Stevens & Company, Mercer Island, Washington, said the insignia was not intended as a trade-mark. Rather, he said, it is "an index of performance of professional integrity... intended to convey the standards of... the Council."

Ventura County Development

The Los Angeles consulting engineering firm of Wilsey, Ham & Blair has been retained to make a three-year study as a basis for a 25 year development plan in Ventura County, California. Ventura County borders Los Angeles County, and is growing rapidly in conjunction with Los Angeles.

Uniform Building Code for Florida

Governor Leroy Collins of Florida has appointed a committee of engineers and architects to study the damage caused by recent hurricanes and to make recommendations for a new state-wide building code. Members of the committee pointed out that, although this year's hurricanes were not the most violent in history, they caused a great deal of damage, partly because of inadequate building codes. For instance, much of the damage to homes was blamed on the popularity of the low-pitched roof: high, steep roofs stay on because they are pushed down by the wind; low pitched roofs are extremely vulnerable – one with a 2½ in. x 12-ft pitch and a 40-ft ridge has as much lifting power in a high wind as a DC-6 plane.

Governor Collins said he did not want the report drawn up, then left on a shelf somewhere until another hurricane strikes. At present, nearly every city in Florida has its own building code, and these differ from city to city.

New Building Code for St. Louis

The Missouri Association of Consulting Engineers is backing a proposed new building code for the city of St. Louis. The old code specifies the material which must be used for such characteristics as strength and fire resistance. The new code, drawn up by a group of engineers and other construction personnel, is based on performance, specifying only what the material must do, not what it must be. The city administration has backed the proposed change in the code, calling it essential to local redevelopment projects.

Feather River Project

Voters in the state of California have approved the largest bond issue ever authorized by a state – $1⅞ billion to carry out a north-to-south water development plan. The issue passed by a very narrow margin. Approval for the project came from the areas which will immediately benefit from it: sections in the north where the annual flooding will be prevented; and sections in the south which will receive the much-needed water.

The project is expected to take at least 20 years to complete. Major items in the plan are an earth filled dam near Oroville, on the Feather River, and a 540-mile aqueduct. The dam, which at 735 feet above the river bed would be the world's largest, is the most controversial part of the scheme, and may eventually be scaled down.

Meanwhile, the first work on the aqueduct is scheduled to begin in spring of 1962.

New Bidding Plan

The Mechanical Specialty Contractors' Association of Chicago has drawn up a new system of bidding, which is said to eliminate bid shopping, bid peddling, and broker contractors. Known as the "Chicago plan," it calls for separate specifications for each of the four categories of mechanical specialty work: plumbing and sewer age; heating, piping, refrigeration, and automatic temperature control systems; ventilation and distribution systems for conditioned air; and electrical installations. Its proponents claim the Chicago plan is far more effective than bid listing or bid depositories.

State Department of Architecture?

The Mississippi State Building Commission has appointed a three-man subcommittee to negotiate individually with architects on fees for state construction. State representative George Cossar said that the negotiating subcommittee would either reach agreement with architects on fees, or set up their

own architectural departments. Architects in Mississippi have complained of the state's reluctance to pay their suggested fee of 6 percent, noting that increases in engineers' fees are raising the architect's overhead.

Prestressed Concrete Ratings

On the basis of specifications outlined in the Uniform Building Code, the Board of Examiners of the City and County of San Francisco has voted to recognize prestressed concrete construction. Fire resistance ratings for prestressed concrete were established closely following those listed in section 215.3 of the American Concrete Institute and the American Society of Civil Engineers' Joint Committee Recommendations.

Leasing Utilities

A new firm, known as Utilities Leasing Corporation, has been established in Florida to help the building industry get around a recent state ruling against the use of septic tanks in commercial and industrial projects. ULC provides the utilities, to conform to state regulations, and then leases or sells them to the owners.

Women in Construction

Mrs. Lois Acker, of Dallas, was unanimously elected national president of the Association of Women in Construction for the year 1960-61. Mrs. Acker is an administrative assistant and staff member of the Dallas architect-engineer firm of George C. Dahl.

The Engineer as a Writer

Stevens Institute of Technology has joined the ever growing list of organizations concerned over the average engineer's inability to express himself clearly – or at least, clearly enough to satisfy his critics. The trouble, according to the professors at Stevens, is not lack of training in grammar and vocabulary, but incomplete thinking. In order to help budding engineers learn to assemble their thoughts fully and express themselves clearly, the school has inaugurated a required course in "clear writing." Freshmen will write themes on various subjects as an integrated part of their education in other fields. For instance, math students this year have to write two papers on calculus. Stevens authorities say the course has been so successful it will probably be kept as a permanent part of the curriculum.

Coeds Study Engineering

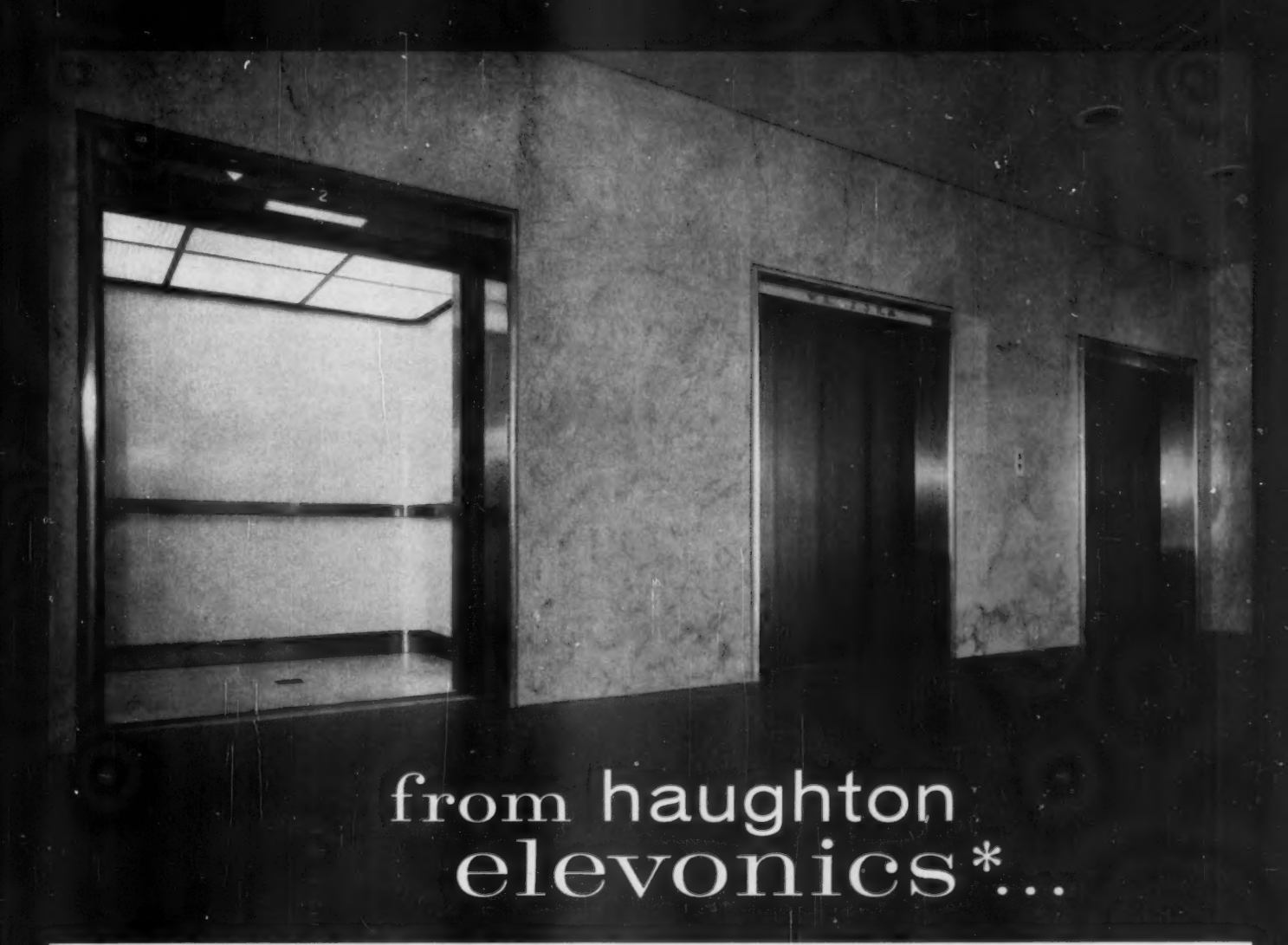
Rensselaer Polytechnic Institute has announced a new program of affiliation with its Troy, New York, neighbor, Russell Sage College, a girl's liberal arts school. The girls from Russell Sage will be able to take math and science courses at Rensselaer, and earn degrees in engineering, architecture, or science. The presidents of the two schools hope to accomplish two goals: increase the number of scientists, and make more efficient use of available facilities.

Motorists' Dream

This year's fall meeting of the U. S. Committee of the International Commission on Illumination heard a report on the latest super highway in Holland – a no-speed-limit four-lane divided road between Rotterdam and The Hague, with continuous illumination three times that of comparable American roads. The Dutch use four sodium lamps on 40-ft poles, delivering about 85,000 lumens per pole. The average in this country is about 20,000 lumens per pole.

Continuous Power from Tides

An experimental French hydroelectric power plant at St. Malo has been put into commercial operation. This is the first full time plant operating solely on tidal force. The unit is in the category of low head hydroelectric projects, and is capable of absorbing peak demands in an electric power grid. The plant can operate alternately



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Giffels & Rossetti, Architects-Engineers The O. W. Burke Company, General Contractor

a new concept of convention center elevatoring for magnificent COBO HALL

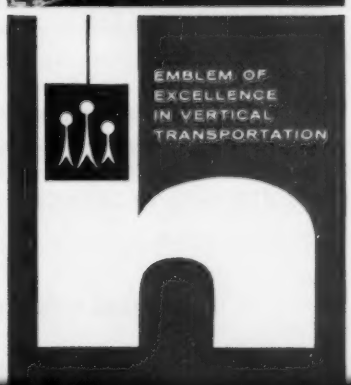
Convention hall elevatoring has its own special problems. And for Detroit's vast new Cobo Hall, where it is said no foreseen convention is too large to handle, there were some special *special* problems.

Here's how they were solved by a specialized system of Haughton electronically controlled elevators.

Designers knew that before and after scheduled events, building traffic would mean a heavy demand for elevator service between parking areas (basement, first and roof floors) and second floor. At other times, comparatively light traffic could be expected between all floors.

Five Haughton automatic units were installed. Cars are big—six feet deep and eight feet wide. A bank of three serves basement, first, second and roof levels. Two cars serve first, second and third floors for lesser traffic needs. All units are motivated by an amazing "electronic brain" that anticipates service needs and dispatches cars at proper time and in proper sequence.

The complete reliability of Haughton vertical transportation is thoroughly recognized by building professionals and owners. We will be glad to provide you with complete information on Haughton design, modernization and maintenance capabilities.



******Haughton's advanced program in elevator systems research and engineering, with specific emphasis on the creative application of electronic devices and instrumentation for betterment of systems design and performance.*

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haughton... *new concepts in vertical transportation for buildings of every type*

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as a generator or pump. During the peak load hours, the tide, or water from the head storage, turns the turbines; during slack hours, the turbines are used as pumps to refiill the storage reservoir.

Engineers' Rebellion?

Russian scientists and engineers, according to professor Albert Parry, of Colgate University, are rebelling against the Soviet leadership of Communist bureaucrats. Doctor Parry, addressing a graduate group at Case Institute of Technology, said there is an unpublicized struggle for power going on within Russia, as the technical intelligentsia becomes resentful of the politicians who claim credit for the work that is being done by scientists.

The Communist hierarchy, in an attempt to control this, is carefully picking for command posts only those men known to be loyal to the party. This was illustrated recently when Khrushchev appointed a new commander in chief of rocket forces, to replace Marshall Nedelin, who was killed in a plane crash. The new man is a staunch party member, with a seat on the Central Committee — but no training in rockets or missiles.

Goal . . . More Money

Separate and unconnected news releases from two different groups may help explain the American way of life. The chairman of the General Electric Company, Ralph J. Cordiner, told members of the National Foreign Trade Council that the overriding aspiration common to all people in the world is the "irresistible determination to achieve new and higher levels of economic development . . . on the whole it is an ambition so widely held that it can help unite people in free nations and build better understanding among them." Cordiner's point was that the free world must help to make this dream a reality. At about the same time, Alan C. Filley wrote an article in the American Management Association's *Personnel* magazine, pointing to the shorter work week as an explanation for the increase in "moonlighting" over the past decade. As a man increases his productivity, it takes him less time to complete his job, he gets a shorter work week — then he can go out and look for a second job and make even more money. This substantially backs up Cordiner's theories.

In Praise of Landrum-Griffin

The White House has received a report from Secretary of Labor James P. Mitchell praising the Landrum-Griffin bill, officially known under the designation of the Labor-Management Reporting and Disclosures Act of 1959.

The Cabinet office said that much progress has been made in achieving protection of rights and freedoms of individual union members, including the basic right to free and secret election of officers; safeguarding workers' funds in union treasuries against misuse; and advancing true and responsible collective bargaining.

"Reports show that in many cases," Secretary Mitchell wrote President Eisenhower, "workers have regained their democratic rights to manage the affairs of their unions where these rights had been lost or denied."

Salt Water Hassle

Ionics, Incorporated, of Cambridge, Massachusetts, has questioned the actions of the U. S. Department of the Interior in awarding a half-million dollar salt water conversion plant contract to a Japanese firm, Asahi Chemical Industries Company. Ionics spokesmen charged that "technically unsound and legally questionable" actions by Interior officials may handicap the national effort to develop a practical desalination program.

The contract in question is for the construction of a test plant for converting 250,000 gallons a day

Designed specifically for **Hot Water** *Operation*

with...

Venturi-Action Mixing-Tube

Venturi-Action Mixing Tube
plays a triple role:

1 It starts by mixing entrained water from the boiler with water entering the boiler.

2 Traveling through the tube, temperature is further modified by the surrounding water.

3 Jet action at the end of the tube directs flow downward and outward against the outer confines of the shell, providing a circulation pattern unequalled in any other hot water boiler.

SUPERIOR "TYPE CC"

This new Superior Hot Water Boiler eliminates the problems resulting from the use of steam boilers for hot-water heating. Most of these stem from improper circulation within the boiler.

Its newly designed Venturi-Action Mixing-Tube achieves a more effective use of the natural flow pattern for maximum efficiency in hot water heating.

In addition to its special hot-water design, features include 4-pass down-draft design, 5 sq. ft. of heating surface per bhp., built-in induced draft, fully automatic operation firing gas, oil or both, and a host of other features described in detail in the new catalog illustrated at left.

For sizes to 11,720,000 Btu's/hr., write for catalog CCW-13.
For sizes to 20,100,000 Btu's/hr., write for catalog CFW-13.

Fire-Tube and Water-Tube PACKAGED BOILERS
for STEAM or HOT WATER

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

SUPERIOR PACKAGED BOILERS

at Webster, South Dakota. The plant will operate on the electrodialysis process, for which Ionics holds basic patents in the U. S. and Japan. Ionics currently has a patent infringement suit pending against Asahi in a Japanese court.

More Cement for Asia

The government of West Pakistan, on the advice of a team of American consultants, is planning construction of three new cement plants, to be financed by the World Bank. The new plants, which will cost about $21 million, will increase Pakistan's cement production by 70 percent.

Fresh Water for Israel

The Israeli Ministry of Development has announced encouraging results in extensive tests with the Zarchin method of desalinating sea water. Zarchin and several other Israeli officials are currently in the U. S. to expedite work on an industrial desalination plant to be built next year in Elat, Israel.

New Publications

¶ The Water Pollution Control Federation has published a technical paper describing the use of two experimental high-rate digesters at the New York City pollution control project. The high-rate installations were converted from standard digesters at the Jamaica Bay station. Copies of the study, *Reprint #439* are available without cost from Dorr-Oliver, Incorporated, Stamford, Connecticut.

¶ The Highway Research Board has released a bulletin on soil compaction and proof-rolling of subgrades. It contains four papers on the subject, presented at the Board's annual meeting. The booklet, *Bulletin 254*, is available from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C. Price: $1.00.

¶ The Air Pollution Control District of Los Angeles County has recommended a brochure put out by the Air Pollution Foundation,

FLEXIBLE thinking

RIGID quality control

INTEGRATED engineering-production

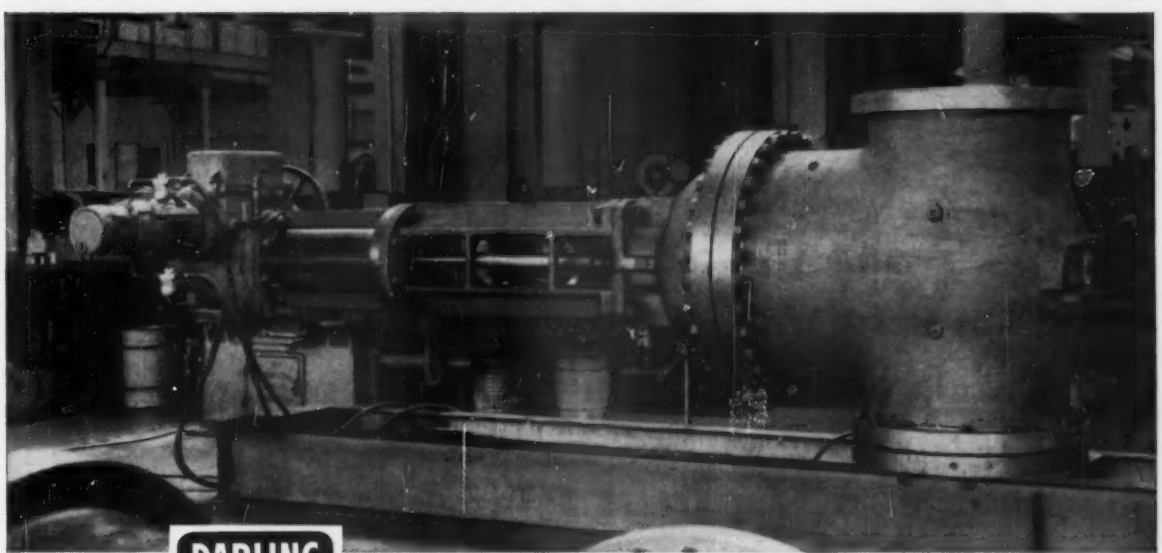
CLOSE TOLERANCE machining know-how

DARLING SPECIALIZES IN SPECIAL VALVES

For example, below is one of fifty-five Darling high temperature valves produced for a large overseas petrochemical plant. Sizes range from 3″ to 36″.

These valves operate at 1100 degrees every 15 minutes. They're designed for service 24 hours a day, 7 days a week, and for years of continuous, maintenance-free operation.

This is typical of Darling's production know-how on valves for special service requirements. Bring *your* special valve problems to Darling.



DARLING VALVES

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 5, Pa.

Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Air Pollution and Smog. The publication gives a summary of the present known facts about air pollution. Copies are available without cost from the Los Angeles County Air Pollution Control District, or from the Air Pollution Foundation, 2556 Mission Street, San Marino, California.

¶ The New York State Association of Consulting Engineers has published a *Manual of Consulting Engineering Practice*, outlining the group's recommendations on procedures for obtaining services, types of services performed, methods used to establish fees, and a schedule of minimum fees. Inquiries should be sent to the Consulting Engineers Council, 326 Reisch Building, Springfield, Illinois.

¶ The proceedings of the 1959 technical sessions of the International Commission on Illumination have been published in four volumes, covering Sources of Radiation, Lighting Technology, Lighting Applications, and Lighting for Transport. Price of the four volume set is $20. Orders should be sent to T. D. Wakefield, The Wakefield Company, Vermilion, Ohio.

¶ The Building Research Institute has published *Cleaning and Purification of Air in Buildings*, the findings of last year's Spring Conference. The material is generally directed toward the decontamination and air conditioning requirements of hospitals. *Publication* 797, Building Research Institute, 2101 Constitution Avenue N. W., Washington 25, D. C. $4.00.

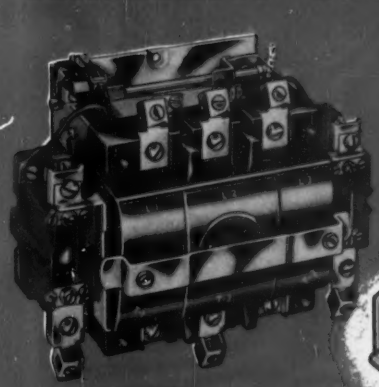
¶ The Industrial and Commercial Power Systems Committee of the American Institute of Electrical Engineers recommends a new transaction paper published by AIEE, *AC System Voltage Nomenclature for Industrial and Commercial Power Systems*. The booklet attempts to standardize voltage nomenclature as used by engineers, manufacturers, and clients. Paper number 60-1182, $1.00 (0.50 to AIEE members) from AIEE, 33 West 39th St., N. Y. 18, N. Y. ▲▲

ANNOUNCING

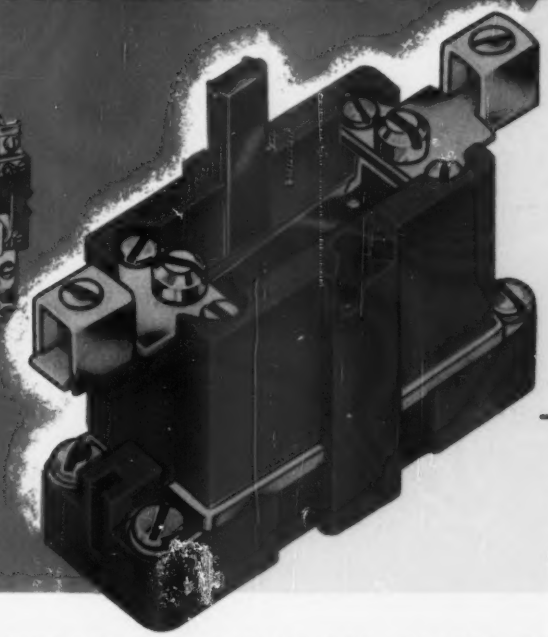
Something NEW under the sun

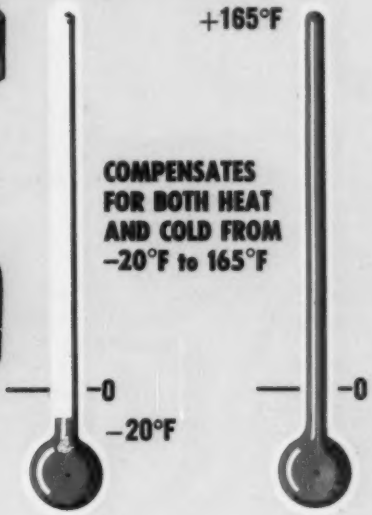
the ARROW AH HART

AMBIENT COMPENSATED OVERLOAD RELAY



FOR ALL ARROW-HART MAGNETIC STARTERS . . . NEMA SIZES 0 THROUGH 5!





RELIABLE AND ACCURATE PROTECTION REGARDLESS OF HEAT OR COLD

Here, for the first time, is a compact overload relay that compensates for both heat and cold, operating on the same time curve at all temperatures from -20° F to 165° F. Compensation is completely automatic. No field adjustment is needed. Operating mechanism is simple, rugged and dependable.

This performance is made possible by the exclusive Arrow-Hart "Balancing Bi-Metal" which is located in a separate compartment and is not; therefore, affected by heat applied to the working bi-metal.

- **MUCH SMALLER SIZE** . . . than any other comparable unit now available. Base size is the same as standard A-H Overload Relays.
- **USES STANDARD HEATERS** . . . and works equally well with either quick-trip or regular type.
- **COMPENSATES AUTOMATICALLY** for both heat or cold, by means of an exclusive, "Balancing Bi-Metal" Effective through a temperature range from —20° F to 165° F.
- **DEPENDABLE IN OPERATION** . . . and requires no adjustments of any kind.
- **AVAILABLE** . . . with all A-H Starters. Ratings from 25 to 300 amperes, continuous current. Normally supplied with manual reset. If desired, relays can be equipped with a change-over lever that provides manual or automatic reset, as required.

IDEAL FOR USE . . .

OUTDOORS . . . in oil fields and other installations subjected to wide seasonal or daily changes in ambient temperatures.

INDOORS . . . for control installations located near boilers, furnaces, heating units or refrigeration equipment and subjected to wide daily changes in ambient temperature.

SEE NEXT PAGE FOR CONSTRUCTION DETAILS and ADDITIONAL DATA . . .

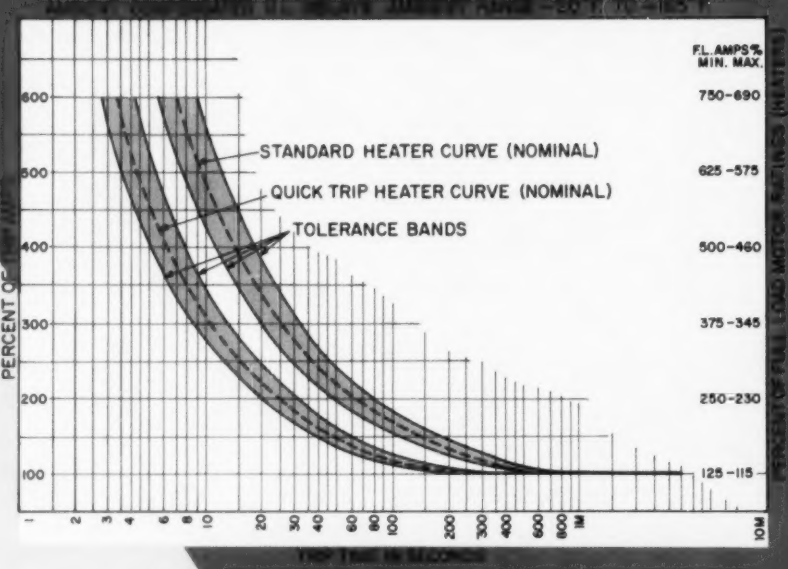
THE ARROW-HART & HEGEMAN ELECTRIC CO., HARTFORD 6, CONNECTICUT

AMBIENT COMPENSATED OVERLOAD RELAYS

WITH "BALANCING BI-METAL"

DEPENDABLE, AUTOMATIC COMPENSATION for A WIDE RANGE OF TEMPERATURE CHANGES

As shown in the accompanying drawing, the working bi-metal and the compensating bi-metal are identical in size and construction and are joined by a coupling bar. As the ambient temperature rises above 72°F, the compensating bi-metal operates through the coupling bar to move the working bi-metal in order to maintain its distance from the trip arm. Similarly, as the ambient temperature falls below 72°F, the compensating bi-metal operates to maintain its distance from the trip arm. Therefore, tripping time remains the same regardless of temperature. Switching mechanism itself employs the same positive snap-action featured in all Arrow-Hart Overload Relays. The calibrating screw permits precise setting. This screw is set and sealed at the factory and requires no further adjustment.



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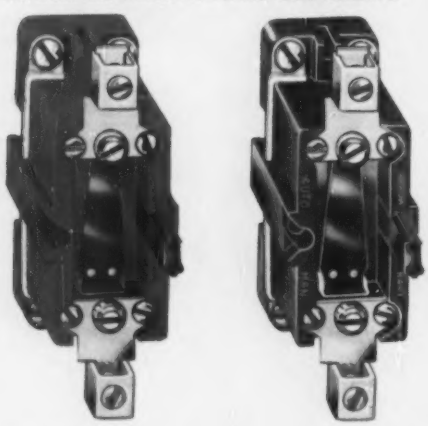
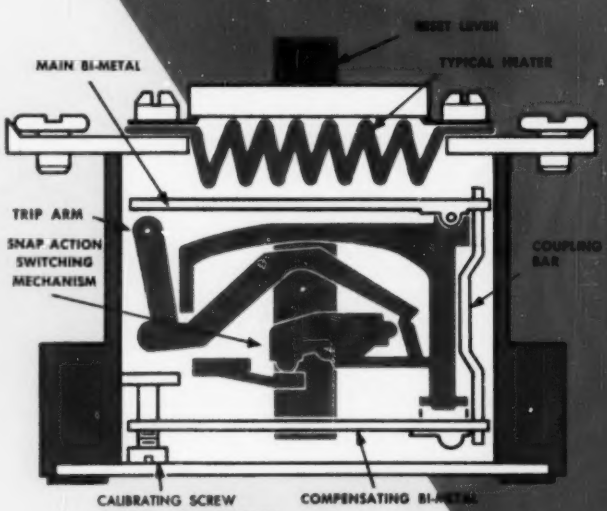
COMPARABLE IN SIZE TO STANDARD ARROW-HART O.L. RELAYS



New Ambient Compensated O.L. Relay

Standard O.L. Relay



PATENT NO. 2,908,786

OPERATES ON THE SAME TIME CURVE AT ALL TEMPERATURES FROM —20° F TO 165° F!

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
103 Hawthorn Street, Hartford 6, Connecticut
MOTOR CONTROL DIVISION

Please send me complete information on the new Arrow-Hart Ambient Compensated Overload Relays with exclusive "Balancing Bi-Metal" Mechanism.

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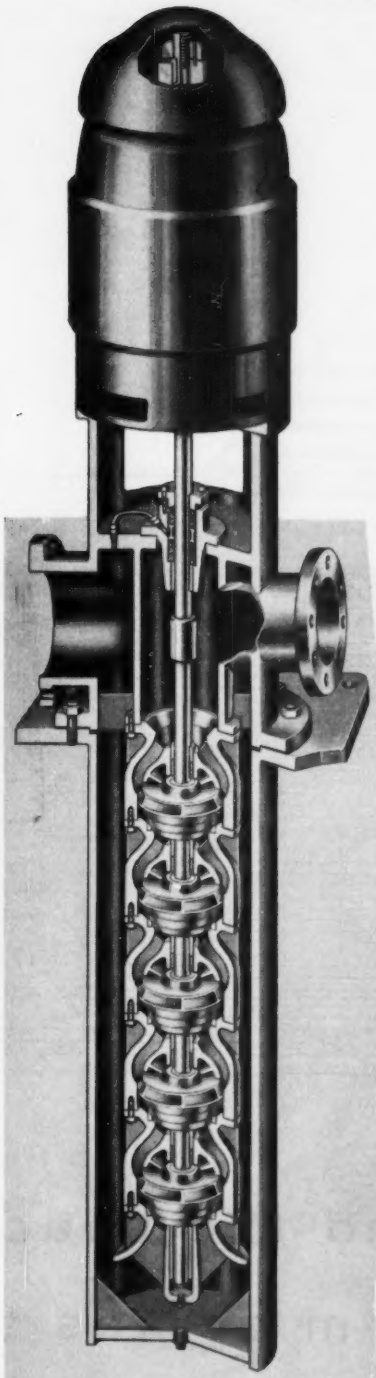
Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

HERE'S WHY Verti-Line* PUMPS GIVE



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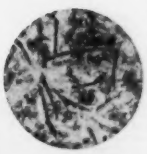

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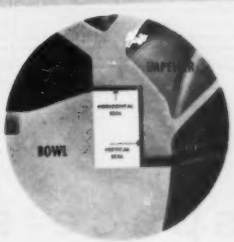

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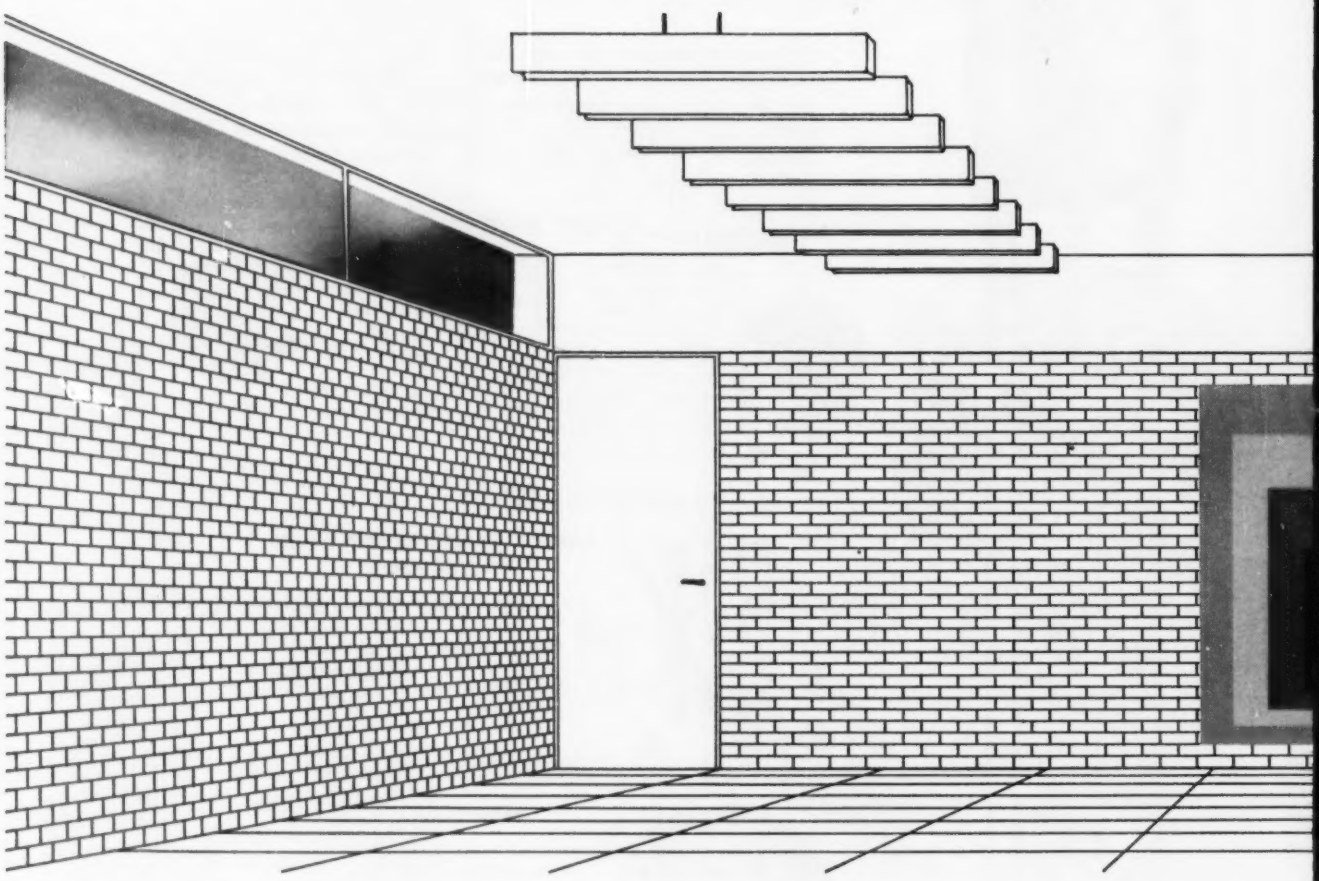

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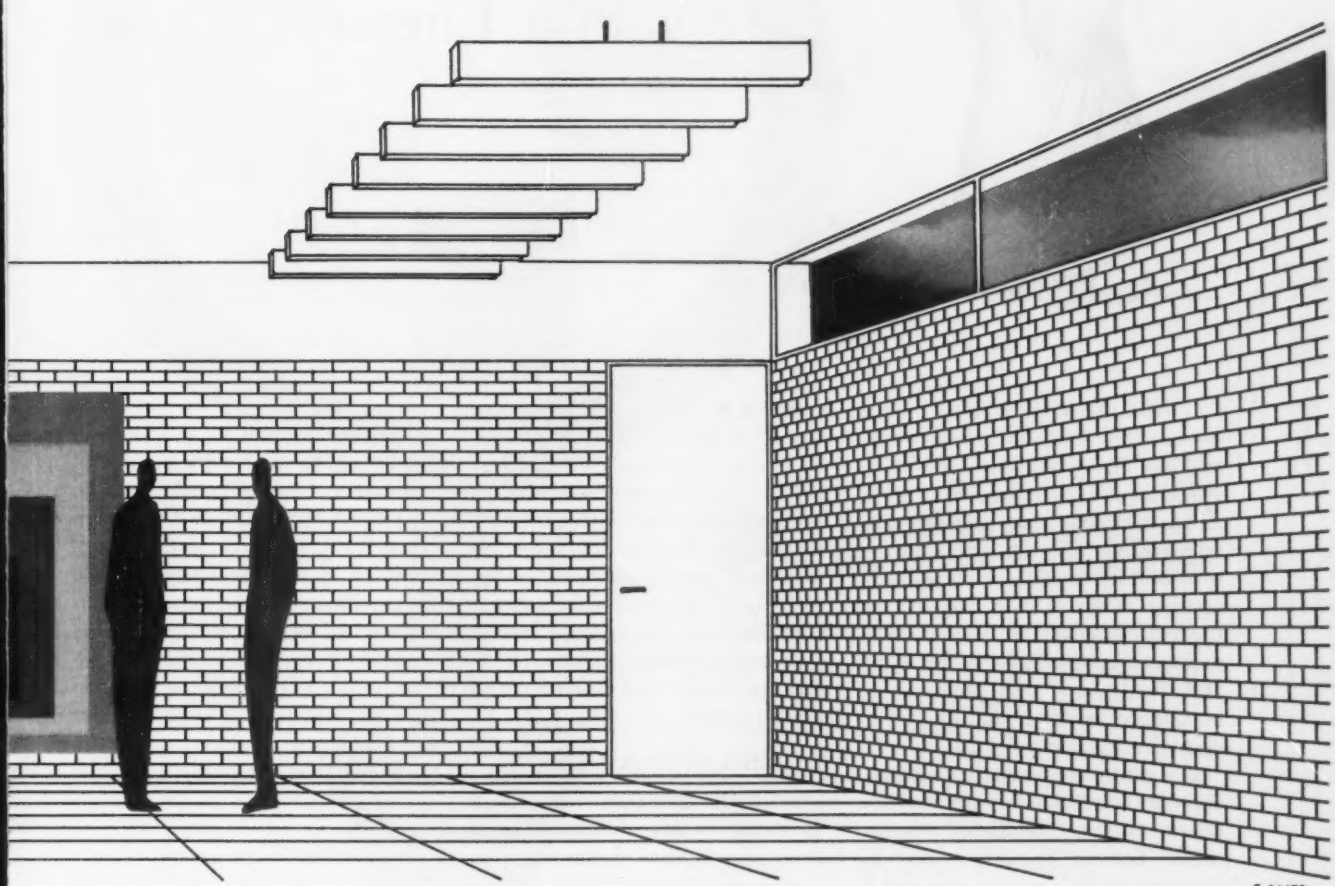

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LEE'S LECTURE

The Scientific Man in a Literary World

JOHN F. LEE
Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

IN HIS PENETRATING little book, *The Scientific Revolution and the Two Cultures,* C. P. Snow speaks of the scientific culture with its roots in objectivity and the natural world, and the literary culture with its roots in the humanities and the affairs of men. He decries the lack of understanding and communication between the scientific and the literary, and points to a confluence of these cultures as a necessity for survival.

It is a commonplace that a scientist who is unfamiliar with Shakespeare would be considered uneducated, but an economist who is unaware of the implications of the second law of thermodynamics could still enjoy the fellowship of educated men. In this scientific age, it is somewhat incongruous that public policy in both domestic and foreign affairs is shaped by men who are predominantly of the literary culture. The technique of using scientific advisers is not adequate, since communication between the two cultures is not adequate. What is needed is a liberally educated leadership – liberally educated in that their understanding of the two cultures is sufficient to support wise decisions based on the advice of specialists. And the specialists themselves must have an understanding of both cultures; their advice must be included in the context of the human and natural elements of the real world. It is within the areas of specialization and general leadership that engineering education enters the intellectual community of the university.

Education for Engineering

One of the characteristics of engineering which differentiates it from pure science is the fact that engineering decisions must include human as well as natural factors. Hence engineering education has an opportunity and a responsibility to join the two cultures. Such an education demands a rigorous basis in the humanities, social sciences, and physical sciences as a prelude to specific education in decision-making in engineering problems of major importance. This decision-making includes high-level design, research, and development. Routine or minor decision-making, important as it is, does not require such a rigorous and broad-based education, and can be sustained by a core of so-called practice engineering courses with peripheral courses in the physical sciences, the social sciences, and the humanities. As a matter of fact, the percentage of the population capable of profiting from the more rigorous education needed for broad and important decision-making is statistically small. Therefore, it would not be practical, or desirable, for all colleges of engineering to offer such rigorous programs.

Purpose

One can justify the establishment of a new university virtually anywhere, in view of the expected tidal wave of students, even if the advantages of higher education are rigorously restricted to those applicants who are competent to profit from them. However, if this were the sole purpose in establishing a new university, everyone would be infinitely better off if it never happened. A university must have an important purpose, independent of the number of prospective students, to justify its existence. There is not enough space here to discuss in detail the many

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facets of the purpose set for State University on Long Island. However, one facet is particularly germane to the main topic under discussion in this article.

The College of Engineering at the State University of New York on Long Island will devote its full resources to the type of program which prepares for major decision-making. Known as an engineering science program, the traditional departments of engineering – civil, mechanical, electrical – will be absent. Instead, functional departments, such as thermal sciences, electrical sciences, solid-state mechanics, and fluid mechanics, will be established. Specialization will not be offered at the undergraduate level, nor will service courses be offered in any part of the university. Students of engineering will have to compete with majors in the humanities and students in the humanities will have to compete with engineers and scientists in science courses.

Approach

A rigorous program, such as the one described, can be accomplished within four years. First of all, it is expected that a large proportion of the students will continue their studies in the graduate schools of the university. Second, the admission requirements will demand a high level of preparation for college. For example, students will begin calculus on the day they arrive on the campus, permitting the introduction of thermodynamics in the sophomore year with fluid mechanics. The admission requirement of courses in general physics and general chemistry will permit the consolidation of more modern physics and chemistry in a common freshman course. The foundations for rigorous work in solid-state mechanics and more advanced solid-state physics will be established before the beginning of the second semester of the sophomore year.

Parallel work in philosophy, economics, psychology, history, and sociology, along with work in the sciences and mathematics, will be required, as well as the engineering sciences. By the beginning of the senior year the student will be equipped to intelligently analyze and synthesize a large variety of engineering systems incorporating scientific, economic, and sociological factors in the decision-making process. An opportunity to elect advanced courses, such as the microscopic behavior of matter or advanced field theory, will be available to all students in the senior year.

Goals

This type of education will accomplish two goals: it will prepare students for graduate study, leading to major responsibilities in research and development; and it will prepare those students who terminate their education at the bachelor's level for major decision-

making in the general practice of engineering. It is fully expected that students terminating their formal education at the end of four years will be well equipped, through basic education and senior-year experience, to do the kind of imaginative and creative design so badly needed in the practice of engineering in the years to come.

One question often asked is whether a state university can restrict itself to the preparation of one type of engineer. The fundamental answer is that any university, whether public or private, is under obligation to maintain the integrity of its academic programs as a first task. The peripheral advantages of a university to the community it serves must be viewed as dividends coming from the academic program — not the *raison d'etre*. A more specific answer might emphasize the fact that most state universities prepare a single type of engineer, educated along traditional lines — dual programs have rarely succeeded. Furthermore, important additional facts need to be given a careful evaluation:

¶ No single institution of higher learning, public or private, can undertake to be everything to everyone.

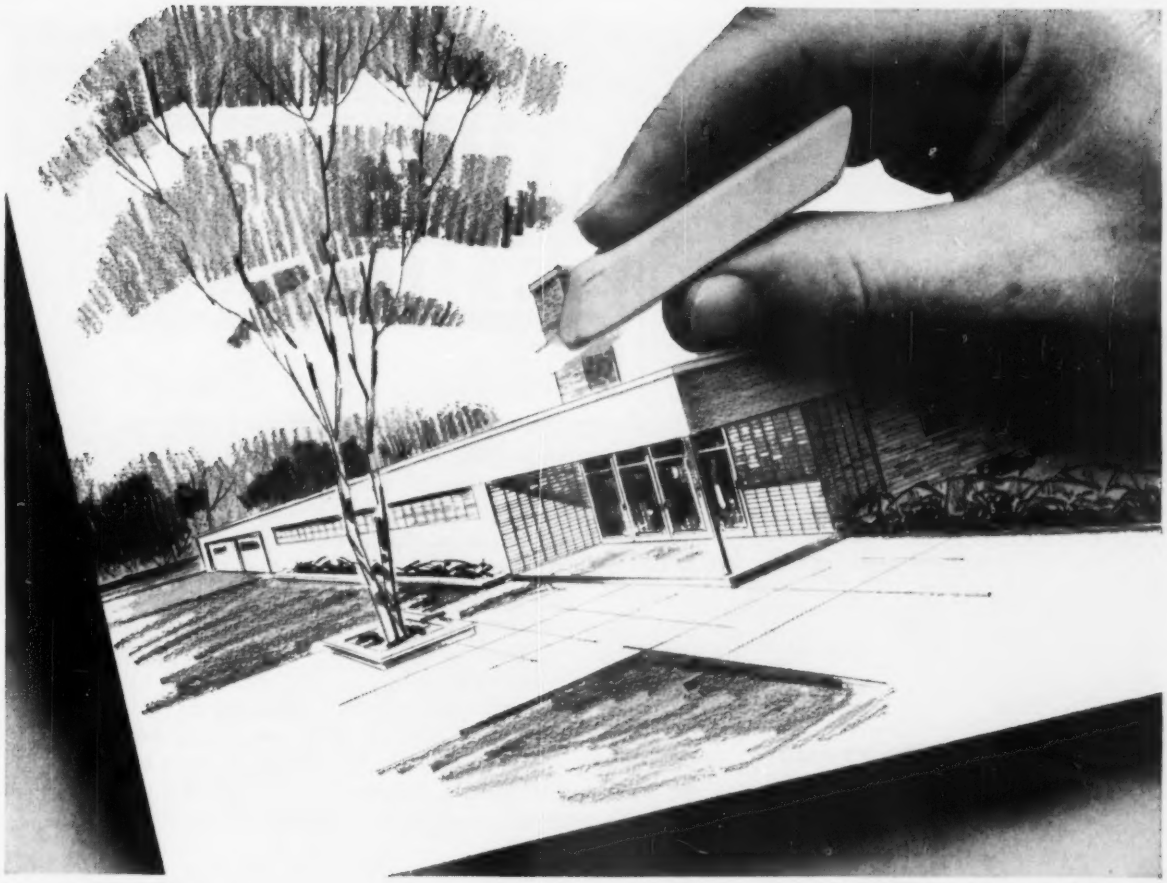
¶ Each particular institution must consider what it can do well with the resources available to it.

¶ Every institution must recognize those needs which are not being met by the other institutions with which it shares the total burden of higher education.

Final Considerations

It is generally recognized that much of traditional engineering will pass in time from the realm of the university to the technical institutes. The graduates of the institutes are occupying an increasingly important role in routine decision-making in the practice of engineering. The next decade may witness the passing of drafting as a means of engineering communication, for even now much of it could be supplanted by data processing machines which direct the operations of machines in automated factories. Many of the highly formalized and routinized design problems which occupy huge quantities of engineering time today are beginning to be solved much more quickly, accurately, and economically by computing machines.

It is understandable that engineers who were trained to do specific tasks well should wish to maintain the status quo. It is for them, in a very real sense, a matter of survival. It is also understandable that the management of a profitable business would naturally wish to maintain its present practices as long as they work well. But the history of the industrial revolution and the danger signs warning us of our declining competitive position in world markets give clear evidence of the need for change ▲▲



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The Readers' Guide

Survey of the Profession . . . A Decade of Growth
page 110

"There are so many facets [of growth] that nearly every firm able to continue in practice can find some direction in which it has grown." Over 23 hundred firms took part in CONSULTING ENGINEER's Survey of the Profession this year. Among other things, we found that, in the past ten years, the number of consulting engineer firms in this country has more than doubled, and the net worth of the average firm has increased by about 15 percent. Unmistakably, the past decade has been a period of growth – impressive growth.

Shoreline Preservation
page 96

"The economic welfare of seafaring nations has depended throughout history on the depth and conditions of estuaries, inlets, and harbors." Doctor Per Bruun, of the Coastal Engineering Laboratory at the University of Florida, explains the developments in his work to prevent erosion and destruction of our coastal beaches and harbors.

Architects and Engineers
page 102

"I suspect that the differences in skills and interests vary more within than between the professions of architecture and consulting engineering." Philip Will, president of the American Institute of Architects, suggests that architects and engineers are more alike than either admits, and proposes new curricula for design professions.

Economic Outlook 1961
page 105

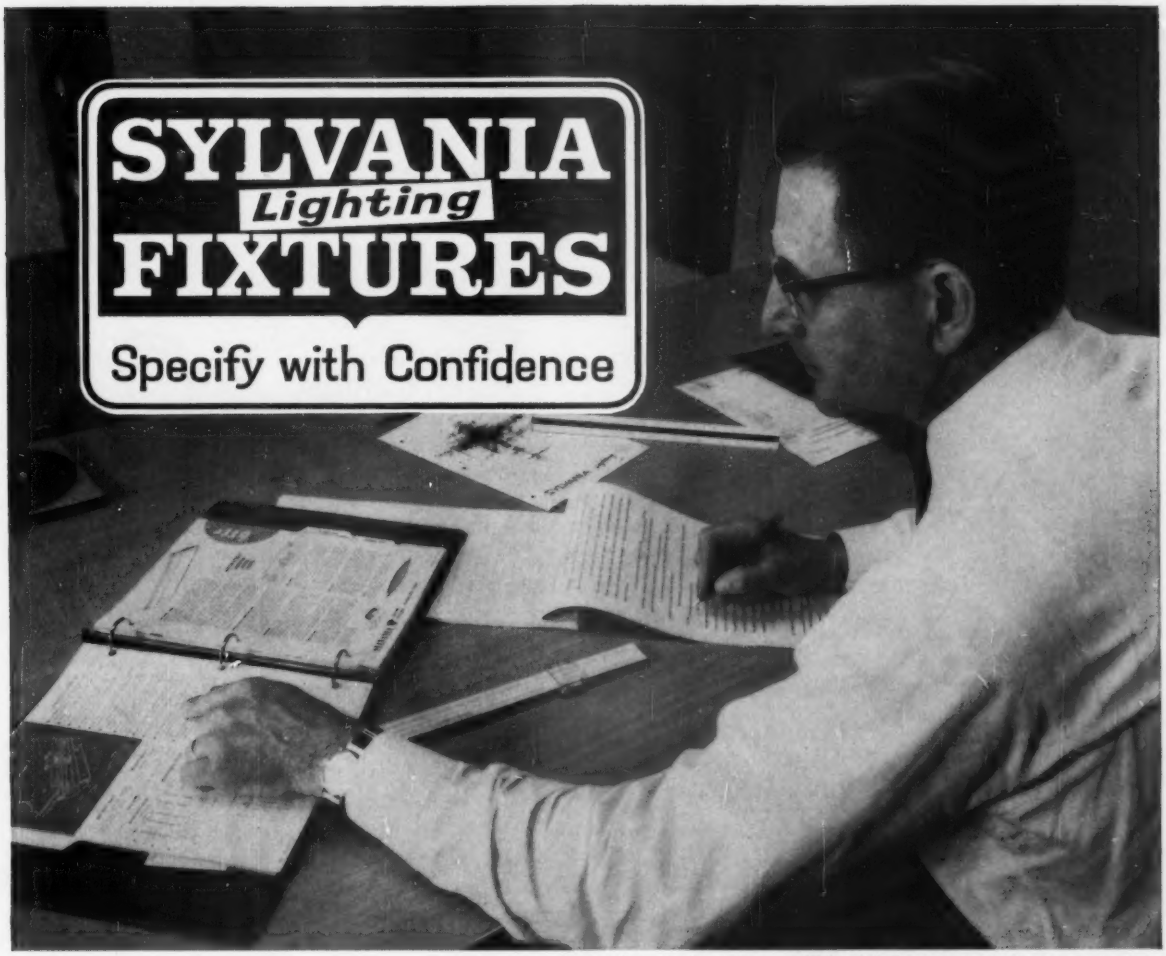
"Moreover, there can be no complacency when unemployment, already between 3.4 and 4 million, promises to be much higher early in 1961." Doctor Jules Bachman, research professor of Economics at the University of New York, studies the economic factors which will be of most importance to consulting engineers in the coming year.

Folded Plate Structures
page 118

"The architectural effect of the shell design can be dramatic, especially when there is a cantilever projection of the slab beyond tne supports." Kansas City engineer Milo Ketchum describes the basic forms and shapes used in planning folded-plate concrete shell structures, with pictures of some of the more impressive examples.

Wind Tunnel Design
page 123

"The trend toward testing at higher and higher Mach numbers has sharply increased the problems of higher inlet temperatures and pressures." West Coast engineer Charles Helin considers the changes in design requirements for wind tunnels, with particular attention to the problem of providing power for today's high-speed test sections.



Photographed in the offices of Lawrence W. Hornfeck, Consulting Electrical Engineer, Pittsburgh, Pa.

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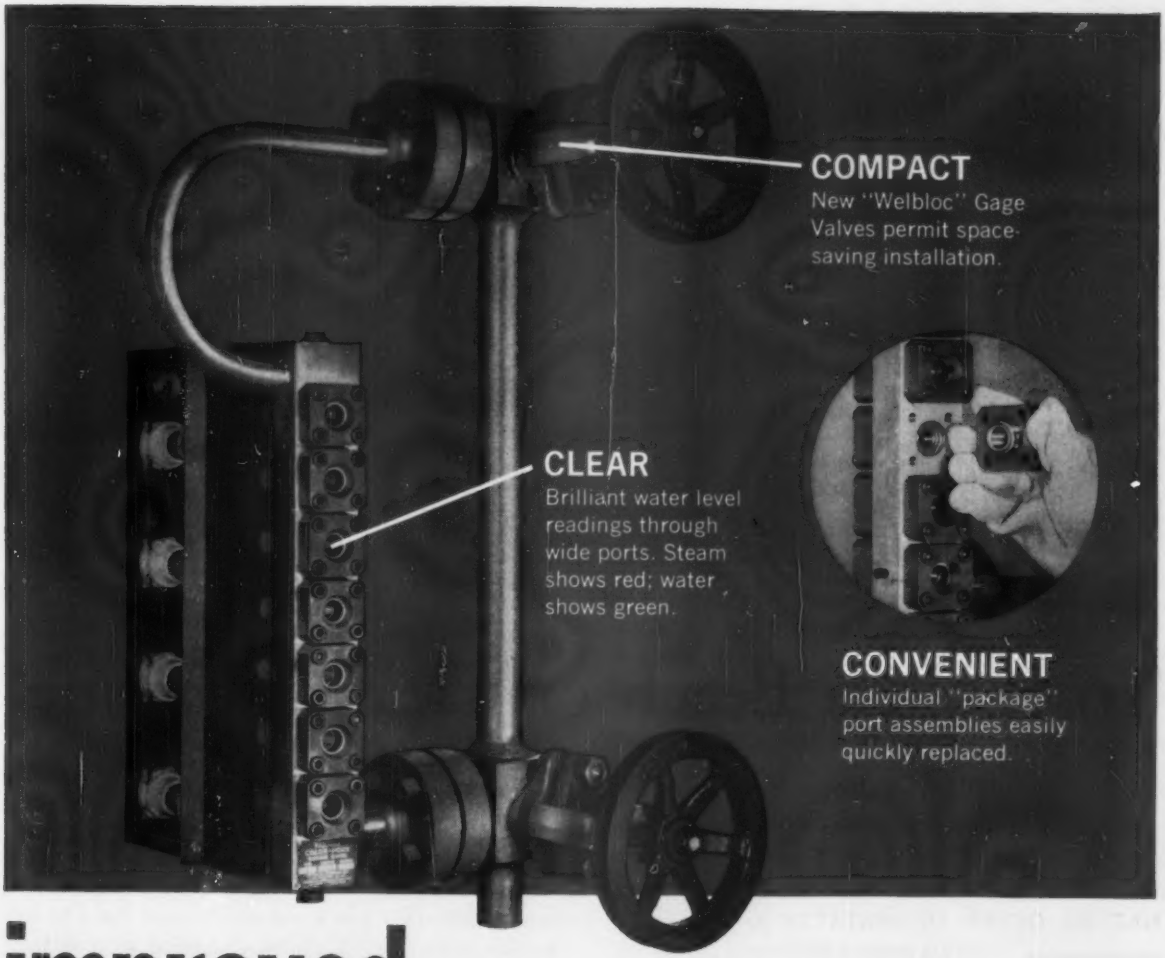
Our Authors

Per Bruun, head of the Coastal Engineering Laboratory at the University of Florida, was born and educated in Denmark, and has spent his entire career in the study of coastal problems. Since 1941, he has been consulted on coastal protection and harbor maintenance problems by Denmark, Venezuela, Iceland, Nicaragua, and several departments of the United States Government. He has several dozen publications to his credit, and a list of honors including a Fulbright legacy. Doctor Bruun is a registered engineer in Denmark and in the State of Florida. His article on the preservation of harbors and beaches begins on page 96.

Philip Will, Jr., president of the American Institute of Architects, was born in upstate New York, and received his professional education at Cornell University. In 1942 he became a partner in the Chicago firm that is now Perkins & Will, and, as partner in charge of design, has won 15 awards and medals and 20 citations for design for the firm. Will was elevated to Fellowship in the AIA in 1951, and has been active in the Society, serving as vice-president and chairman of many committees. His comments on the relations between architects and engineers, with some suggested changes for design education, are on page 102.

Charles J. Helin was born in upstate New York, and received his degree in electrical engineering from Rensselaer Polytechnic Institute. In 1941, he moved to the west coast, where he worked for Lockheed Aircraft throughout the war. Helin then joined the California Institute of Technology, remaining there from 1946 to 1953, when he opened his own consulting firm in Los Angeles. A member of CEC, AIEE, and CEAC, he has done extensive work on test projects, including rocket test stands, wind tunnels, and altitude chambers. Helin's article on the problem involved in the design of high-speed wind tunnels begins on page 123.

Milo Ketchum, senior partner in Ketchum, Konkel & Hastings, of Denver, received his bachelor's and master's degrees in civil engineering from the University of Illinois, where his father was the Dean of Engineering. Ketchum taught at Case for six years before entering private practice in 1943, and opened his present office in 1945. He is especially well-known for his thin shell concrete designs, which have been used in industrial plants, commercial buildings, schools, clubs, and hotels. His article, on page 118, is based on a section of *Types and Forms of Shell Structures,* a book he published privately in 1959.



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The 150 ft wave tank at the Coastal Engineering Laboratory of the University of Florida, designed and built by the author.

To Build a Beach or Clear a Channel

DR. PER BRUUN
University of California

NATURE OFTEN UNDERTAKES her own engineering projects for coastal protection. CE *exclusive* A natural headland acts as a jetty or a groin; islands and reefs serve as breakwaters, accumulating material behind them; outcroppings of rock or shell, or stones left behind when land is eroded, serve as seawalls. Rivers nourish a beach by bringing new sand from inland areas.

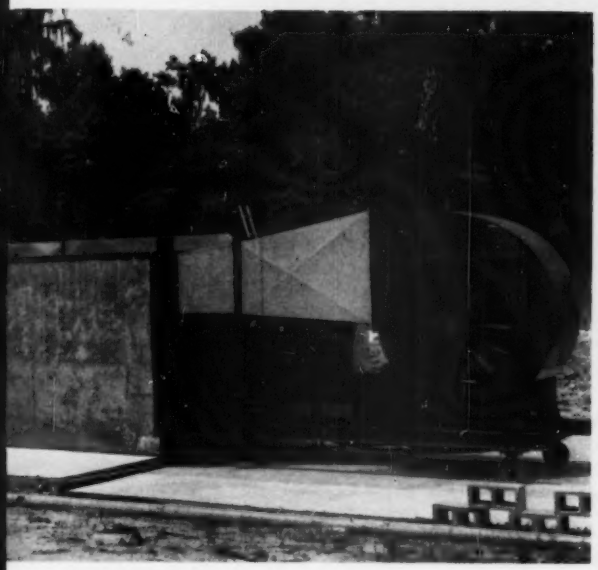
But nature does not always build these structures just where man wants them. Man himself must build jetties, groins, breakwaters, and seawalls. To preserve a particular coastal area, he may have to resort to artificial nourishment, pumping in more sand.

SEAWALLS ARE BUILT to protect the area behind them from storms and high tides, but they do not accumulate material to build up a beach. When built of sheet pilings so as to form impermeable walls on the shore close to the water's edge, they actually increase erosion of the beach. If they cannot be built far inland where they are touched by wave action only under storm conditions (not at every high tide), then vertical seawalls should be avoided.

Sloping walls of different types, impermeable structures as well as permeable rubble mounds, are more considerate to the beach and can be built closer to the water's edge. Fig. 1 shows a sloping sand-asphalt revetment with a berm or boardwalk, designed for a Southeastern Florida open seacoast. It is designed to be built of natural beach sand, but it is often necessary on this type of earthwork to add fine filter material as well as coarse sand to the natural sand. The asphalt mixture specification should vary according to sand composition and the location and steepness of revetment. There should be 10 to 20 percent asphalt in the base layer, which is then painted with a layer of asphalt with high penetration and surfaced with a light material such as coarse sand or shell. The base layer can be reinforced with steel or sisal cord.

Another type of revetment can be built of interlocking concrete blocks resting on a filter blanket of woven nylon, plastic, or fiberglass, as shown in Fig. 2. The construction of this type of revetment requires a careful builder and constant supervision of the work to make sure all blocks are interlocked and all joints covered with filter material.

In bays and lagoons wave action is less than on the open sea, and vertical sheet-pile walls may provide a practical solution. Protection against oversplash-erosion behind the wall can be obtained in several ways.



Gravel layers separated from the sand fill by woven plastic filter blankets are one solution; slabs or interlocking concrete block slabs are another. For badly exposed sections, a rubble mound in front of the wall is a practical addition.

GROINS ARE WALLS built perpendicular to or perhaps at a slight angle to the shoreline. They act to accumulate material and build up a beach on the side toward which there is a littoral drift, but impermeable, non-adjustable groins, particularly when built rather high, cause leeside erosion. Low sand asphalt groins have been built in Maryland, in New Jersey, and at Fernandina Beach, in Florida. Gentle slopes were used on the northern beaches, and results have been quite satisfactory. The Fernandina installation, with rather steep slopes, started deteriorating quickly.

Permeable groins of various designs — often patented — are in use but have generally been unsatisfactory. They are of little value even in normal weather, and they almost always fail during storms, when they are most needed.

The best groin is either the very low, impermeable, non-adjustable groin or the impermeable, adjustable type. These adjustable groins are built of 14 by 16 inch prestressed concrete king piles. These are cast with grooves into which 4 by 8 inch timbers, preferably creosoted pine, greenheart, or imported hardwood are fitted. If waves are bad and the coast is exposed, a rock fill, resting on a nylon or plastic filter blanket, should be used at the extreme end of the groin. This is particularly advisable when improperly driven piles cause stability problems. Fig. 3

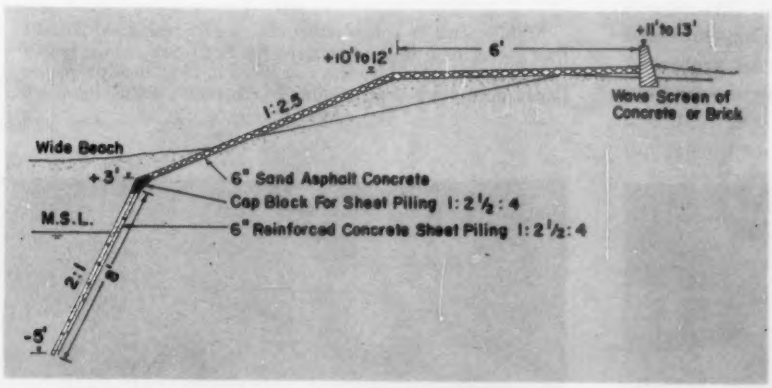


Fig. 1 — A sand-asphalt revetment, made up chiefly of natural beach sand. The asphalt specification varies with the sand and the degree of the slope.

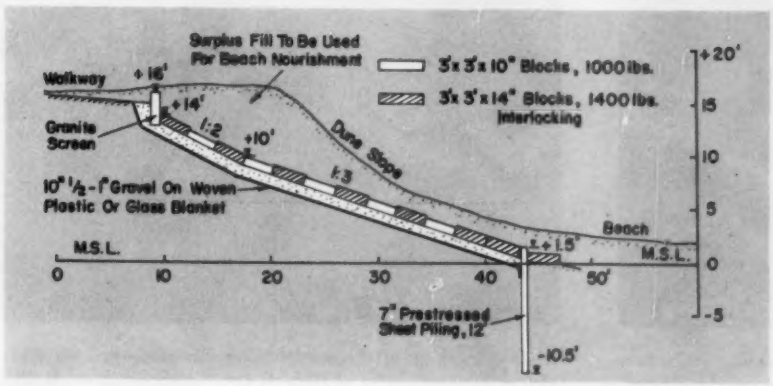


Fig. 2 — A revetment built of interlocking concrete blocks. The filter layer is usually a sheet of plastic, woven nylon, fiberglass, or similar material.

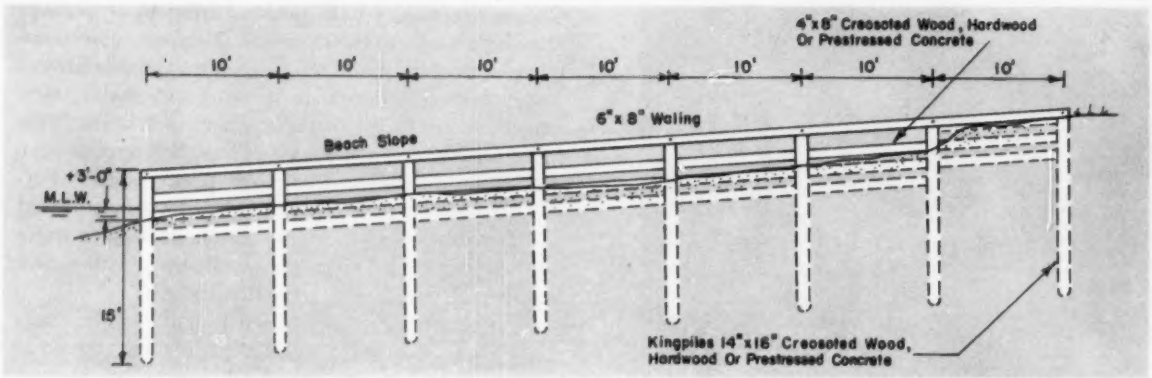


Fig. 3 — Adjustable groin, built of prestressed concrete piles. Its height must be adjusted carefully to prevent leeside erosion.

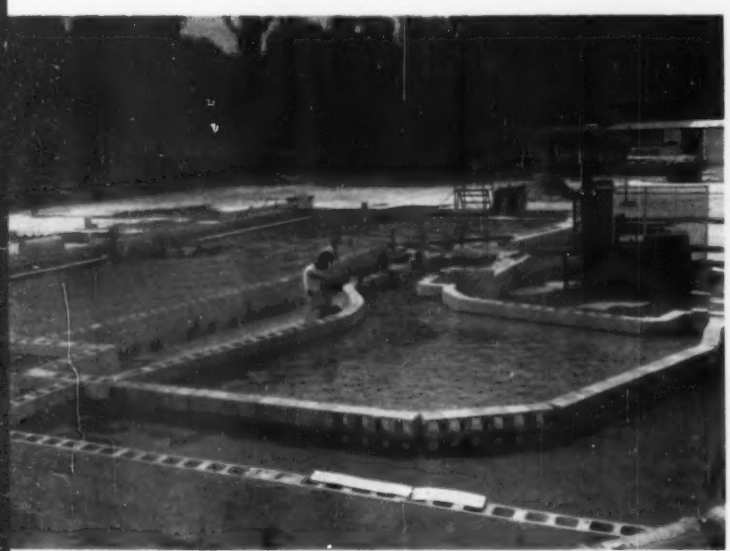
shows an adjustable groin. Its height should be carefully regulated, permitting material to pass over it at all times, to avoid adverse erosion.

Leeside erosion may be reduced by constructing a group of groins with their extreme ends on a smooth curve approaching the shoreline asymptotically. The most advantageous distance between groins in a group should be about 1.5 to 3 times the reach of groin into the sea under normal storm conditions, but this depends upon local conditions of the beach, the offshore profiles, the beach material, and wave and current conditions.

DIKES ARE A SPECIAL TYPE of seawall. They are used when valuable, low-lying areas are to be protected. Sea coast dikes are often replacements for natural dunes which have been washed away by the sea.* They should be located at a safe distance from the shoreline and should be protected from wind erosion by some vegetation. A species of ammophilia is used extensively both in Europe and on the East Coast of the United States, particularly at Cape Hatteras National Seashore, Manteo, N. C.

If a dike has to be located close to the shoreline, it will need a protective surface. Sand asphalt is excellent for this and has been used extensively in the Netherlands, most recently in the huge Delta project in southwest Holland.

*While actually a dam rather than a dike, the great 20 mile long enclosure in Holland between the North Sea and the Zuider Zee, or Ijsselmeer, which was completed in 1932, finally replaced dunes destroyed in a great storm on Christmas of the year 1295.



The pools at the Coastal Engineering Laboratory, where working copies of existing shore conditions can be studied.

A close-up view of the model set up to study erosion and navigation conditions at Boca Raton. Study made in 1959.

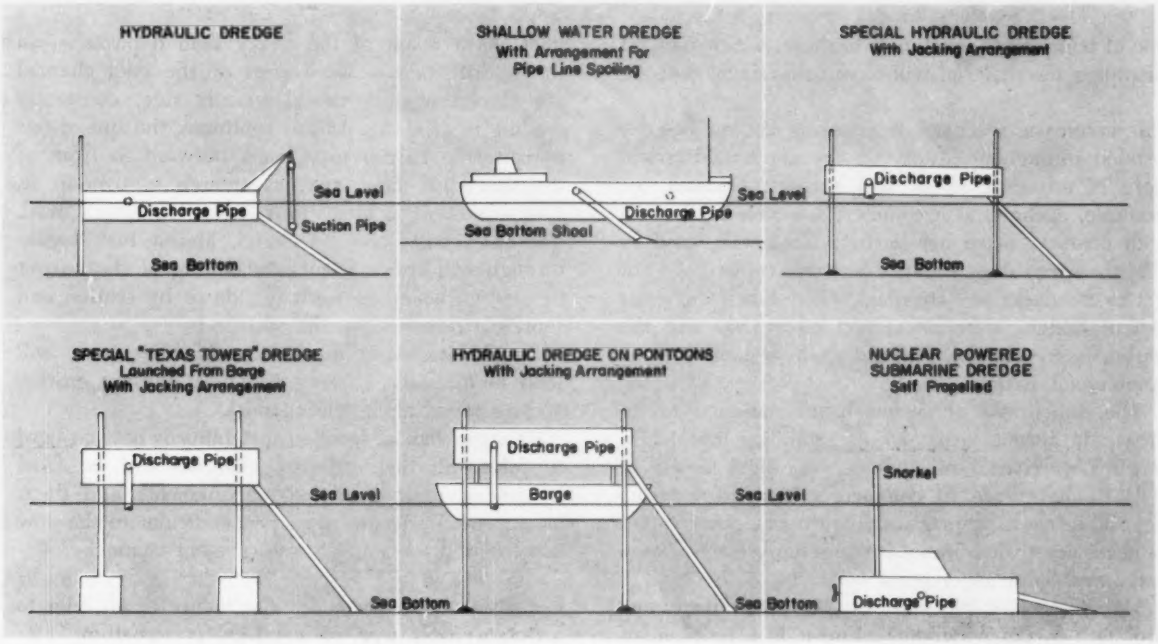


Fig. 4 — Six existing and potential methods of dredging off-shore sand for use in artificial nourishment of beaches.

It is customary to build coastal roads behind dikes, usually with a drainage ditch between the dike and the road. Examples can be seen in Holland, Denmark, and along the Outer Banks of North Carolina.

ARTIFICIAL NOURISHMENT is the newest method for fighting beach erosion. It is a new field, and tests are still going on with two systems: one uses material dredged in bays and waterways and deposited on the beach; the other makes use of by-pass arrangements, with the sand piped across an estuary or inlet. Sand plants for artificial nourishment of beaches can be permanently installed. They require some sort of feeder arrangement (a dragline or submersible scraper), or they may run the pump along a trestle, picking up the material wherever it can be found.

A scaled reconstruction of the Sarasota Bay, Big Pass, and New Pass, Florida, shore conditions. Study made this year.

It has been the common practice in the past to get the sand for beaches from some inland source, thereby eroding the shore from the rear also. Soon we must consider extending our supply lines for material to the ocean bottom. As a result of numerous new developments, sand material for beach nourishment already is scarce in many bay areas. The lower Gulf coast of Florida is a good example of the absolute necessity of having sand-wells established a considerable distance out on the ocean bottom where suitable materials are available.

Fig. 4 suggests several approaches to ocean-based dredging operations. The simplest, but not always an adequate solution, is the shallow water dredge, which can pump material from offshore shoals of bays and other protected waters. The Texas tower solution can be useful where extensive sources of good underwater sands exist. The suggestion of an atomic powered submarine dredge may seem premature, but a dredge of this type may be in operation within the next five to ten years. The problem is not simply one of dredging from a submarine but also

one of pumping the materials to shore. A new method of piping the material will have to be developed.

THE ECONOMIC WELFARE of seafaring nations has depended throughout history on the depth and conditions of estuaries, inlets, and harbors. Holland, for example, declined as a commercial power in the late 18th century, when her harbors filled with sand so that the cargo ships engaged in world trade could not get to the docks at Rotterdam. Then, when the great steam dredges were developed after 1860 and the harbors were cleared, Holland again became a great commercial nation.

The dimensions of vessels have continued to increase in recent years, so the stability and maintenance of coastal inlets have continued to be of critical importance to commerce. Just a few years ago, 30-feet was a practical depth, but now 50-feet is necessary to accommodate supertankers and large cargo vessels at major ports.

Maintenance of inlet stability is a three-dimensional problem. In the horizontal plane it is a problem of location stability; in the vertical plane it is a problem of cross-sectional stability, involving both width and depth. The history of an inlet generally demonstrates a continuous change in geometry by which the lengths of channels as well as the cross-sectional areas vary continually. Inlets on a littoral drift coast will eventually be closed by the sand material that is continually deposited at the inlet. Fortunately, at some inlets there is a natural passing of sand, so that it is moved across from one side of the inlet to the other. (See Fig. 5, Oregon Inlet, N. C.).

Wherever there is a prevailing littoral drift, an inlet will shift location by migrating in the direction of the drift. The rate of this movement depends on the drift magnitude, the velocity of tidal and other currents, and the phase difference between any longshore tidal currents and the tidal currents of the inlet. As a result of the heavy sand deposits — on the updrift side — the waters of the inlet channel are forced against the downdrift side, constantly eroding it. (Fig. 5). As this continues, the spit of the updrift side barrier may reach outward in front of the downdrift land area as though to overlap it. This condition is likely to be relatively short lived. The inlet will soon be closed, and a new breakthrough will result from overflooding of the barrier by storage water on the bay side or by erosion and shoreline recession on the seaside.

In addition, long inlet channels, like rivers, will tend to meander, causing irregular, shifting erosion and accretion along the channel.

This problem of location instability is not too hard to solve. Shifting entrance channels can be fixed by jetties, and protective embankments and dams or current-interfering spurs perpendicular to the flow can be used to establish a permanent channel.

CROSS-SECTIONAL STABILITY, the ability of an inlet to maintain itself free of deposits, is something else again. Any tidal inlet on a littoral-drift coast is in a state of dynamic equilibrium. During flood tide, littoral drift material is moved in the bayward direction by the flood currents. Depending on the configuration of the inlet and shoals and the depth of the bay, some of this is returned to the sea by the ebb currents, but some of it, especially the finer material, is left on the landward end of the channel, thereby building up bay shoals. On the seaside the coarser material returned by the ebb currents will build up an outer bar. This differs from the inner shoal in that the material is not so permanent. This outer bar can function as a natural bridge over which sands move across the inlet entrance.

Most inlets shoal as a result of continuous prolongation of the inlet channel, whether this prolongation takes place in the sea, in the bay, or both.

Fig. 5 — Natural passing of sand at Oregon Inlet, North Carolina. Picture on the left taken in 1945, the other, at the same spot, in 1949.

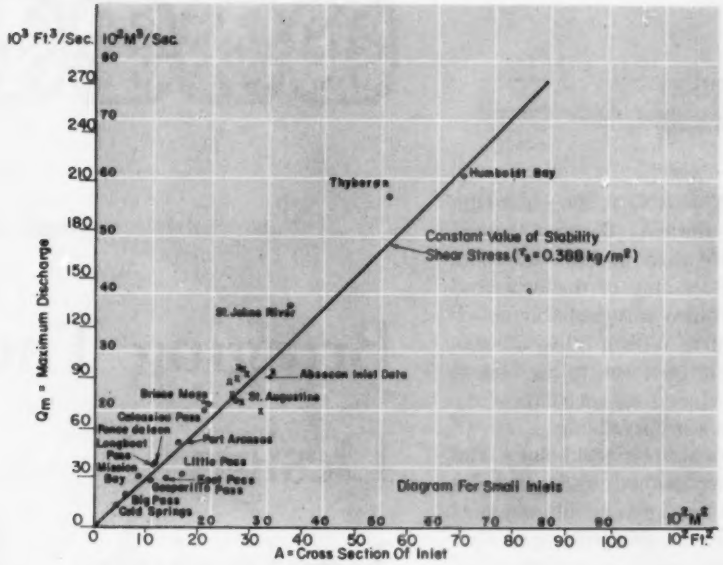


Fig. 6 — An analysis of cross-section stability, based on studies in Holland, Denmark, and the United States.

Inlets that are in a deteriorating state can shoal as a result of excessive amounts of sands deposited by one violent storm. The splitting up of the main channel into two or more channels also will cause shoaling, as will any change in tidal flow such as might be caused by dams or other projects.

This means that the most difficult and involved problem in inlet stability is stability of the cross-section, for contrary to location stability, shoaling always is present, and it involves continually varying shifts and changes of an irregular nature. Detailed studies of tidal inlets on shores of alluvial material have shown that in order to obtain a stable inlet channel, it is essential that littoral drift material be supplied to the inlet.

It is possible to make a mathematical analysis of cross-section stability. Fig. 6 presents the result of some studies based on existing data derived from inlets in the United States, Holland, and Denmark. The solid line of Fig. 6 represents the relationship:

$$A = Q_m \div C\,(\tau_s \div \rho g)^{1/2}$$

Here, A is the cross-section of the inlet; Q_m is the maximum discharge (spring tide); C is Chezy's C (a factor of flow resistance); ρ is the density of water and g is the acceleration of gravity. The value of the constant τ_s, representing stability shear stress, varies from about 0.50 kg/m^2 for heavy littoral drift and sediment load, to 0.45 kg/m^2 for medium conditions, and down to about 0.35 kg/m^2 for lighter littoral drift and sediment load.[1]

Reference:
1. *Stability of Coastal Inlets*, P. Bruun and F. Gerritsen; North Holland Publishing Company, Amsterdam; 1960

The study further showed that the ratio Ω/M where Ω is the volume of the tidal prism in cubic yards per tidal cycle, and M is the littoral drift in cubic yards per year, exceeds 600 for the most stable inlets and exceeds 150 for medium stability inlets. Inlets with Ω/M ratios lower than 150 are normally in a deteriorating stage.

DESIGN OF A TIDAL INLET in alluvial material is simply a hydraulics and structural problem in which the cross-section for navigation is determined by a relationship involving flow, flow resistance, and bay, lagoon, and inlet channel geometry. As such, the importance of model studies for proper design of inlet channels cannot be overestimated. Studies of flow distribution in the model will assure that actual tidal flow will give the inlet, the bay channel, and the protective jetties the best configuration and most stable and economical cross-section.

Model experiments should include movable bed studies so that detailed attention can be given to erosion and accretion actions in the entrance and channel areas at the same time that the influence of the jetties on the longshore drift is investigated closely. An improved inlet channel does not have to go straight through the barriers or run straight through shoals. Experience has shown that it may be better if the channel is not absolutely straight. A light curvature seems to counteract any tendency toward random, uncontrollable meandering. This can also be investigated properly by model experiments, the cost of which are so low that there is scarcely any justification for omitting them. Only by such research can our navigable waterways be preserved. ▲▲

CE exclusive

Bringing The Design Professions Together

WILLIAM LE BARON JENNEY, the great Chicago architect, was the first designer to use the skeleton steel frame. He died in 1907, the 50th anniversary year after the founding of the American Institute of Architects. His office was probably as advanced as any in the country. With a 30 to 35 man staff, it may have been the largest. Yet, to the best of my knowledge, his staff included no mechanical engineers, and no consultants were available.

Those were the days of a simpler technology. Hot air was the common heating method, and gas lights were the accepted method for artificial illumination. Mechanical installations were worked out on the job with cooperating contractors, and I am told that Jenney's first "mechanical engineer" was a steamfitter who was smart enough to lay out pipe and radiator on paper rather than on the job. Whether this is fact or myth, it is true that the use of consulting engineers for design in the building industry is a relatively new procedure. Building reached the complexity which we now accept as normal in an amazingly short time.

IT IS NOW CLEAR that both architects and engineers are vital to the building industry. Their services have become indispensable for all but the simplest structures, and even simplicity may be the deceptive reflection of design talents so skilled as to appear effortless. Beyond rudimentary shelter the public expects a constantly rising standard of utility and environmental control. Inconvenience and discomfort, once accepted as unavoidable, are now intolerable. Construction simply cannot begin until someone has designed and organized on paper all the complex elements that make up a modern building.

Under these conditions, the fraternal bickering which pointlessly separates rather than unites the consulting engineer and the architect is trivial and unproductive. Important things need to be done that will really challenge our highest skills. Our reserve energies should be used to strengthen our bonds rather than sharpen our differences. (I suspect that the differences in skills and interests vary more within than between the professions of architecture and consulting engineering.) The professional relationships and performance of the architect-engineer design team can be greatly improved if we attack our problems in cooperation, rather than competition with each other.

THE EDUCATION of our next professional generation is our greatest problem. I am aware that the engineering profession is deeply concerned with engineering education. Committees have been at work for years. But, unfortunately, consulting engineering for the building industry is low on the list of proposed college courses. It is hard to compete with the glamor of electronics, cybernetics, space vehicles, and jet propulsion. One unhappy result is that most of the brightest young men are lured into engineering careers in other fields. Another is that those engineers genuinely interested in designing heating, ventilating, and air conditioning systems, as well as structures, lighting,

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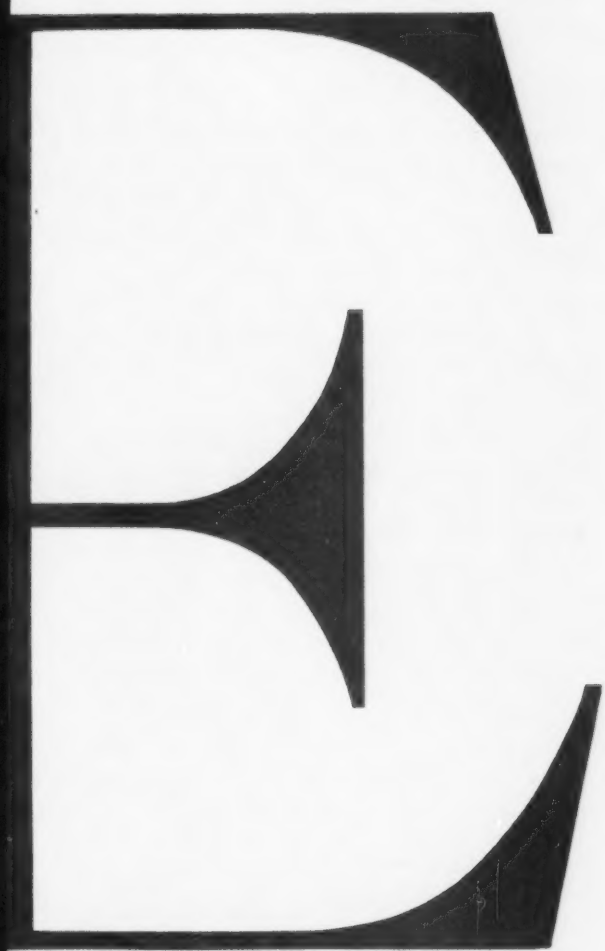

power wiring, and sanitary systems find that in colleges of engineering they are tolerated as little better than stepchildren. For their degrees they are required to carry a dominant overload of secondary subject matter which contributes neither to their professional training nor to their basic cultural background.

I am aware of the nostalgic longing of the educators to produce "engineers" first and specialists second. A generation ago this was a realistic and realizable goal. But today our technical knowledge has expanded so fast that yesterday's educated scientist is today's novice. Relative to the knowledge of the times, the "Renaissance Man" was possible only in the Renaissance. This is not to say that our purpose should be to produce an army of narrow, Russian style technicians, but technical curricula do need to be more carefully shaped and pruned. We need not fewer but more specialized divisions of engineering education.

THIS LEADS TO my first suggestion. It is simple and as old as the yearning of man for knowledge. Let us begin our education with the broadest cultural trunk. It encompasses the basic arts and sciences tied historically to the long development of the human race. Its purpose is to give a man a framework for the full life, a vantage point from which knowledge, human behavior, and aspirations can be seen, interpreted, and interrelated. Without such a background, man's endeavor is measured at the lowest level of animal satisfaction, without understanding, accomplishment, or high purpose. Unless its members are so educated and motivated, how can the design professions give the public the professional guidance it so desperately needs to shape our physical environment.

But the trunk is not the whole academic tree. There are main limbs, secondary branches, twigs, and leaves. As the vision and self understanding of the student increases, he will find some area of knowledge and endeavor more congenial and promising, more suited to his own mental and physical equipment. This is, for him, a main limb. A choice to follow it further up the tree need not mean a decision for ultimate specialization. The choice, however, sets a direction. The student might, for example, decide that he would find reward in some facet of the building industry. Perhaps he is sensitive to his physical surroundings or merely enjoys putting things together to create an object that can be seen, touched, and identified as something he has created. At this point, it should be unnecessary for him to commit his untested native abilities to a future in construction management, product design, architecture, or engineering. All specialties related to building have so much in common that a substantial block of academic time could well be devoted to common studies. As the student's skills and interests become more evident to both himself and his teachers, he may move up the tree from a limb to a specialized technical branch.

THIS LEADS TO my second suggestion. Why not combine education for the building industry in a single

academic curriculum? Still vivid in my memory is the interschool bantering between architects and engineers. Natural as such rivalry may be, it was, and still is, symptomatic of very real mutual disrespect – long hairs vs. the slide rule boys, aesthetic vs. practical.

Though originating in immaturity, much of this interprofessional distrust and misunderstanding carries over into later years. Communication between architect and engineer becomes difficult, and a shared goal is replaced by narrow rivalry. Both professions suffer from frustration, teamwork becomes difficult, and the design of the project suffers. Much of this rivalry would be eliminated if the architects and engineers were educated in the same school. Within such a university subdivision, all the special skills required by the construction industry could be taught. Not only would there be specialized courses, but many which would bring all students together in a classroom. These latter courses, plus closer contact between students and faculty, would tend to unite the professions. Through understanding and shared aspirations, the beginnings of a new spirit in the building industry might develop. In addition, and of equal importance, we could expect a tightened curriculum properly designed for the students' intended careers. We have business schools, colleges of medicine, and colleges of agriculture. Why not colleges of building arts and sciences – colleges of the environmental arts?

MY FINAL SUGGESTION is made with some trepidation. Practical men, who like their files and pigeon-holes, will call it unrealistic; academicians, who are comfortable with the ordered sequences of the departmental course catalogs, will call it naive. Nevertheless, I propose that we abandon academic degrees. Obviously, the consequences to the now well ordered house of education would be frightening to contemplate. Without AB's, MA's, MS's, and PhD's, how would we know who is what? How could we establish a proper "pecking order?" How would we set salary scales? Without honorary degrees, how would small colleges attract wealthy donors or commencement speakers? In fact, there would be no commencement. But, perhaps the oddest consequence of all would be a shift of emphasis from education for the sake of degrees to education for the sake of learning.

Anyone who attends a few educator's meetings is aware that individual learning is now the popular doctrine. At each age level each student is an individual. Each has his own personal abilities and motivation. It follows that one does not teach classes; one teaches individuals. Each should be encouraged to enlarge his mental horizons at his own best rate. At one end of the scale we provide special facilities and teaching for the retarded. At the other, we have at last recognized that it is not undemocratic to give special attention to the gifted.

To the layman peeping over the educational fence from the outside, all this looks very logical – particularly if his child is placed among the gifted. Being a layman, and limited by knowledge of academic routine, he might, however, begin to wonder how the theory of individual learning can be consistent with the lockstep of degree governed curricula. Why must all these cherished individuals take identical courses? In practice, what is the goal at which the system really points? Learning? Or the acquisition of a degree?

IT IS NOT DIFFICULT to imagine an educational institution founded for the sole purpose of learning. Outwardly, it would differ little from any university. There would be deans, professors, and an administration. Perhaps the guidance staff would be unusually able. Perhaps the professors would be more noted for teaching than for writing in the professional journals. With no degrees there would be no arbitrary requirements, either as to course selection or time of residence. The limits would be self-imposed or inborn. The object of education – learning.

From such a school it is natural to expect that the alumni would range from the marginally useful, through the technically competent, to the professional statesman of human understanding, vision, and leadership. At the lower end, the student would not waste his time and substance in useless struggle toward a degree symbol. At the top, we may find and cherish those special individuals who are blessed with responsibility, capacity, and high purpose. On such as these we can ill afford to do less than lavish our best educational talent. Twice the basic four or five years of college may pay enormous dividends. For, within whatever fields they may select, these are the future leaders of our country, and the world.

Educational reform is not the panacea for all the ills and differences between nations, persons, or professions. But it may help. And, if heart is added to sharpened reason, we may achieve the kind of wisdom which will guide each of us to accept and develop our creative roles in an atmosphere of mutual satisfaction and respect. ▲▲

The Economic Outlook 1961

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CE exclusive

DURING THE THIRD quarter of 1960, gross national product was $503.5 billion, a decline of $15 billion from the highest level ever reached. More important, the total end product demand, which excludes the effect of inventory changes, has risen steadily for each quarter as shown in Table 1. These figures show the basic strength in our economy. It should be noted that end product demand reached new record levels in the third quarter despite the sharp decline in steel operations, despite the lagging tendencies in housing, and despite the end of the inventory accumulation. During the fourth quarter, steel production remained at a low level, the decline in housing appeared to be halted, and some inventory liquidation took place. In other words, the year end situation already reflected the impact of adverse developments in these three areas of the economy.

One of the most important facts to keep in mind is that there has been a shift of almost $15 billion in the inventory sector of the economy, from a rate of increase of almost $11½ billion early this year, to a rate of liquidation of about $3 billion in the last quarter. Nevertheless, the economy as a whole continued at high levels. The maintenance of high level demand reflected the continuing rise in total personal income. In fact, despite the major decline in the steel industry, total industrial production fell only about 4 percent from its all time peak level. One reason why this decline has not spiraled is that almost half of the nation's economic activity is accounted for by Federal, state, and local government purchases ($100.7 billion) and consumer purchases of services ($132.9 billion). These two areas have shown persistent expansion throughout 1960.

It should be noted that the rise of 5 percent in end product demand since the last quarter of 1959 was reflected substantially in real terms, because price inflation has been small during this period. Wholesale prices have remained about the same, but the consumer price index has risen by 1.4 percent, and construction costs between 1 and 3 percent, depending upon which index is used to measure the change (Chart 1).

Construction exhibited diverse trends in 1960. Residential construction declined sharply, public construction, which had declined fairly steadily in 1959, moved forward throughout all of 1960, commercial construction rose irregularly; and other construction remained on a plateau. In the last half of 1960, the total volume of new construction remained fairly steady at an annual rate of about $55.3 billion (Chart 2). For the entire year, private nonresidential construction increased by almost $2 billion, public construction stayed about the same, and residential building fell by about $2.5 billion (Table 2).

Apparent Weaknesses

This review is not intended to imply that there are no signs of weakness in our economy. One of the disturbing facts is that new orders have been running below deliveries so that the backlog of unfilled orders has been declining. Moreover, there can be no complacency when unemployment, already between 5.4

TABLE 1

END PRODUCT DEMAND AT ANNUAL RATE
(in billions of dollars)

1959	4th quarter	481.7
1960	1st quarter	489.9
1960	2nd quarter	499.7
1960	3rd quarter	502.9

and 4 million, promises to be much higher early in 1961. Nor can we ignore the disturbing implications of the deficit in the international balance of payments with the resulting outflow of gold, the lack of buoyancy in fall business activity, the narrowing of profit margins in many industries, or the projected decline in new investment in plant and equipment.

Nevertheless, we have already seen the effect on our economy of a decline of 46 percent in steel operations, 17 percent in residential construction, and a swing of almost $15 billion in inventories. The important point is that these adjustments did not significantly affect other segments of the economy and bring about a reduction in total economic activity.

New Factors

The economic environment has experienced several changes which are becoming increasingly important in evaluating business prospects. In the last year or two there have emerged several new factors which were not present in the earlier postwar years. These will play a significant role in the business outlook and in the outlook for corporate profits.

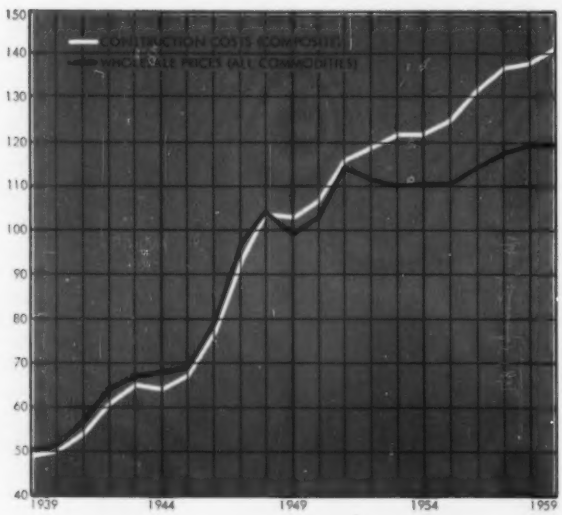


Chart 1 — Changes in construction costs & wholesale prices from 1939 through end of 1960, based on 1947-1949=100.

Intensification of competition — The earlier postwar shortages which accompanied the high level of deferred demand have given way to surpluses. Since the end of the war American industry has invested over $400 billion in new plant and equipment. The result has been a major addition to total capacity, with several consequences which are sometimes overlooked. First, there is less urgent need for new plants and equipment to meet prevailing and prospective short run demand. To an increasing extent, new plant and equipment expenditures have been designed to increase efficiency, thereby reducing costs rather than increasing total capacity. Second, ample supplies of goods are available and output can be increased readily if new demand emerges. This has an important bearing on the size of inventories carried.

The intensification of competition from abroad has resulted in some pressure on domestic prices. Many illustrations can be cited, including textiles, transistor radios, heavy electrical equipment, cameras, and aluminum. The number of products affected by such competition will increase rather than decrease. Moreover, the opening up of the St. Lawrence Seaway has heightened the impact of foreign competition in the Middle West because of the freight savings involved in direct shipment by water.

Containment of inflation — Wholesale prices on the average have remained generally unchanged for 2½ years, while consumer prices have risen modestly. The rise in consumer prices reflects primarily the wage inflation in the service industries. Construction costs also are increasing less rapidly (Chart 1).

A shift from price inflation to stability significantly affects the expectations and planning of many businessmen. The incentive to build now because it will cost more tomorrow is dampened down. The willingness to speculate in inventories tends to be curbed. Business decisions are made in terms of basic requirements rather than distorted by the hope of outguessing the next surge of price inflation. Price stability has been a major achievement of the past two years. That it has not been accompanied by even larger disturbances to the economy than those described earlier is the really heartening news concerning our economy in recent months.

Whether we will have a renewal of the inflationary spiral in 1961 will depend to a large extent upon the types of programs proposed by the new administration and accepted by the Congress. However, powerful barriers against a significant price inflation are provided by the large supplies of goods available, the excess capacity, and the lagging tendencies in the economy of this country.

Outflow of gold — This represents a fundamental change in our international position. A continued outflow of gold from this country would represent a real threat to the stability of the dollar and to our

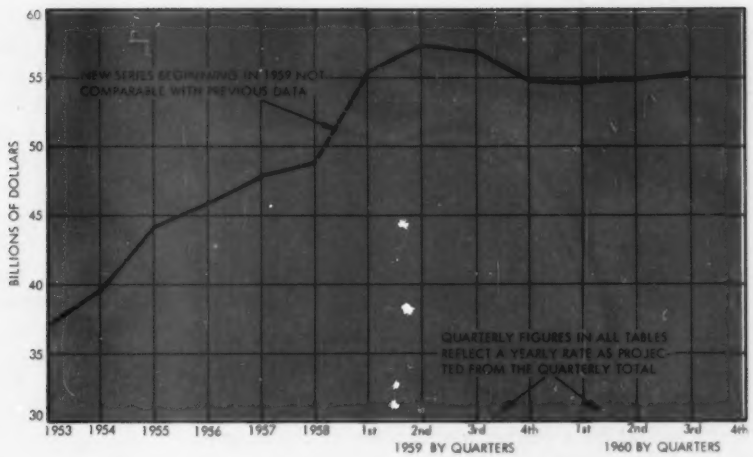


Chart 2 — Total volume of all new construction started, 1953 to 1960.

own economy. Such a development would be harmful both to ourselves and to the rest of the world.

Moreover, because of the gold outflow, we have less ability to utilize monetary policy as a countercyclical device. Some of the credit balances accumulated by foreigners move from country to country in response to differentials in interest rates. If we want to counter recessionary developments in our economy by lowering interest rates, we must recognize that such a move may be accompanied by an accelerated outflow of gold with resulting loss of confidence in the stability of our own economy.

Labor costs — Throughout the earlier postwar years, the ability to pass higher costs on to the consumer, in the form of higher prices, apparently made many industries reluctant to fight seriously against excessive increases in labor costs. The inability to control costs during the 1958 recession came as a rude shock to many companies. One consequence has been a stiffening of attitude toward excessive increases in wages and nonwage benefits and the initiation of a drive against make-work rules and featherbedding, both of which add unnecessarily to costs.

Increases in average hourly earnings (Table 3) have declined below the 1956-57 level. Even more important are the signs of some progress against featherbedding. In Detroit, painters agreed to eliminate premium pay for using rollers. In Chicago, plumbers have agreed to remove restrictions on the use of power tools and to permit cutting, welding, and threading of pipes off the job site. In New York City, electrical workers agreed to increased automation, the use of power driven tools, and a reduction in some specific inefficiencies.

It is probable that in the period ahead there will be a further intensification of the resistance against

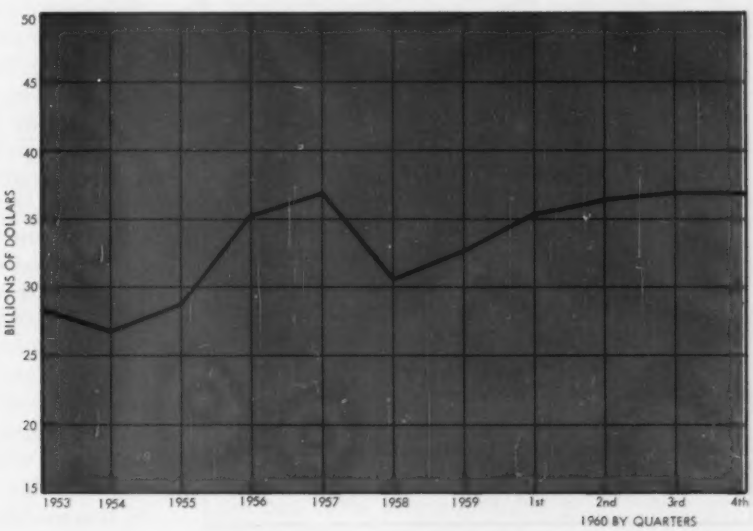


Chart 3 — Total industrial spending for plants and equipment, 1953-1960.

TABLE 2

TOTAL CONSTRUCTION
(in billions of dollars)

	1959	1960 (est.)
Residential	24.5	22.0
Private non-residential	15.3	17.0
Federal, state, & local	16.3	16.0
Total	56.1	55.0

excessive wage and other labor cost increases. One result would be a further modification of the magnitude of wage inflation. This would make it much easier to continue to have relative price stability.

Credit outstanding – From the end of 1945 to the end of 1959 total private debt increased from $139.9 billion to $547.5 billion, or 291.4 percent. It is an eye opener to compare this increase with that which took place during the 1920s, a period which many students describe as having experienced an excessive expansion in credit. Total private debt increased from $91.5 billion in 1918 to $161.2 billion in 1929, a rise of $69.7 billion, or 76.2 percent.

Nonfarm mortgage debt increased from $27 billion at the end of 1945 to $160.8 billion at the end of 1959. During the same period, state and local debt rose from $13.7 billion to $55.6 billion; total corporate debt from $85.3 billion to $281.7 billion. These increases (Table 4) have taken place within an economy that has grown very rapidly. Nevertheless, a larger proportion of the average family's income is now required to service debt than ever before. In view of their tremendous inventories in durable goods, consumers may be reaching the point where further expansion of this debt will be slowed up significantly. A reduction in the rate at which debt is created would represent a new factor affecting total demand – a factor which has not characterized our economy in the earlier postwar years.

TABLE 3

INCREASE IN CONSTRUCTION INDUSTRY WAGES

	Hourly average	Increase ¢	Increase %
1945	$1.38		
1946	1.48	10	7.2
1947	1.68	20	13.5
1948	1.85	17	10.1
1949	1.94	9	4.9
1950	2.03	9	4.6
1951	2.19	16	7.9
1952	2.31	12	5.5
1953	2.48	17	7.4
1954	2.60	12	4.8
1955	2.66	6	2.3
1956	2.80	14	5.3
1957	2.96	16	5.7
1958	3.10	14	4.7
1959	3.22	12	3.9
1960	3.35	13	3.9

Narrower profit margins – These have followed unavoidably from the intensification of competition. To the extent that profit margins and total profits are reduced, undistributed profits also decline. This development can curtail expansion, because such funds have played a significant role in financing new capital investment. Moreover, it must be noted that a narrowing in profit margins reduces the incentive for such expansion in commerce and industry.

These six factors indicate a modified economic environment in which business decisions will be made over the next year and longer. On balance, they could result in a sounder basis for long term economic growth than that which prevailed in the past 15 years. Nevertheless, their modification will eliminate some of the yeastlike elements which have played so important a role in recent years. The competitive struggle will be more intense.

Conditions Affecting the Outlook

An examination of the major segments of the economy reveals neither areas of marked strength nor areas of marked weakness.

¶ State and local spending continues to expand at an annual rate of about $3 billion. At the polls in November 1960, the voters approved about $3.2 billion of the tax-exempt bond proposals presented. This was well over 90 percent of the dollar value of the bonds that were on the ballot. The largest amount approved was the $1.7 billion water bond issue in California. A continuation of expansion in this area seems assured.

¶ Personal income after taxes has been rising steadily, although at a markedly slower pace in recent months. The total in the third quarter, at an annual rate, was $357.5 billion, 5.6 percent higher than a year earlier. Some further increases in disposable income and in consumer spending seem probable. Expenditures for services should continue to rise, but little change is anticipated in the purchase of goods. Smaller purchases of durable goods will probably be offset by larger purchases of nondurables.

¶ Residential housing starts fell from an annual rate of about 1.6 million starts in the spring of 1959 to 1,044,000 in September 1960. In October the seasonally adjusted annual rate rose to 1,192,000 starts. Greater availability of credit could act as a stimulus to new housing starts. On the other hand, the demand for housing is weakened as the backlog has been filled and as family formation has declined. One evidence of the weaker demand is the rise in the vacancy

ratio. Conditions favor a continuation of easier credit, and housing starts will probably increase in 1961.

¶ New plant and equipment expenditures have leveled off at about the third quarter totals, the peak reached during the recovery (Chart 3). Declining profit margins, ample capacity in many industries, and lower undistributed profits will offset the stimulating effects of small declines in long term interest rates. Some declines have been recorded in capital appropriations by industry, hence a decline of several percent in plant and equipment expenditures can be expected through the early part of next year.

¶ Inventories already have swung from an accumulation rate of about $11½ billion early in 1960 to a liquidation rate of about $3 billion in the last quarter (Chart 4). With this swing of almost $15 billion, most of the adverse effects of inventory adjustment have already taken place. While some further inventory liquidation is probable, this area should shift to a plus factor later in 1961. It could be one of the important expansion forces affecting our economy in the second half of the year.

¶ Exports have risen sharply in 1960, while merchandise imports have remained at about the 1959 levels. As a result, the excess of exports over imports has increased to the highest level in the postwar period, excluding 1956 and 1957, which were overstimulated by the Suez crisis. However, some decline in exports would not be surprising because boom conditions abroad have shown signs of tapering off.

¶ Federal spending has been inching upward in recent months. It is probable that a further rise of several billion dollars will take place in 1961 as the new administration seeks to achieve its announced goals and as armament spending rises.

¶ Unfilled orders of manufacturers have declined from $51.5 billion in December 1959 to $46.5 billion in October 1960. The December 1959 total was inflated by the effects of the steel strike, so part of the recent decline has reflected the aftermath of the strike. Nevertheless, new orders have been below sales every month this year except September. Such a relationship is not conducive to a vigorous upturn in economic activity. These data require careful watching in the months ahead for clues about the underlying strength of the economy.

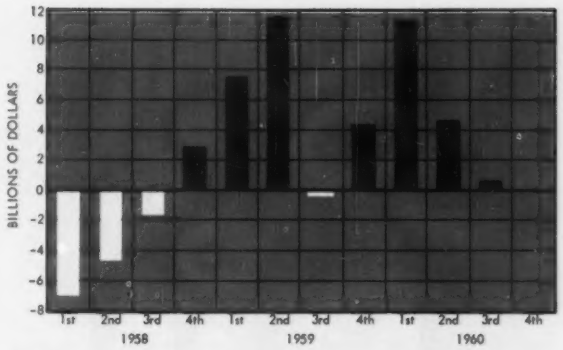


Chart 4 — Changes in business inventory, by quarters, from 1958 through third quarter 1960. Losses shown in white.

¶ The Federal Reserve has been acting since early 1960 to ease credit. On several occasions during the year it has taken steps to increase the reserves of the member banks. The rediscount rate has been reduced twice. Other money rates also have declined. In the fall of 1960, mortgage money was available in somewhat larger supply than a year ago, but interest costs have not declined.

The Outlook for 1961

A balancing of these factors suggests that we will not move far from the high level plateau on which we have been perched for the past six months. Such stability creates considerable anguish among those who have made economic growth a fetish. Nevertheless, it is a highly creditable performance in the face of disruptions attending the steel strike and the dislocations which unavoidably attend a halting of an inflation spiral. During this period, a sounder base is being created for further economic growth, which, from the longer term point of view, is hampered rather than stimulated by inflation.

Nonresidential construction contracts awarded in 1961 should remain at about the present level. Business spending on industrial buildings and factories probably will decline in 1961 while highway building should continue to rise. Spending on state and local government construction should continue to advance and thus act as an offset to a moderate decline in private nonresidential construction. At best, 1961 should see a modest increase of planned construction in residential housing.

Although business activity in the first half of 1961 should continue to be sluggish, some upturn in the latter part of the year is probable. ▲▲

TABLE 4

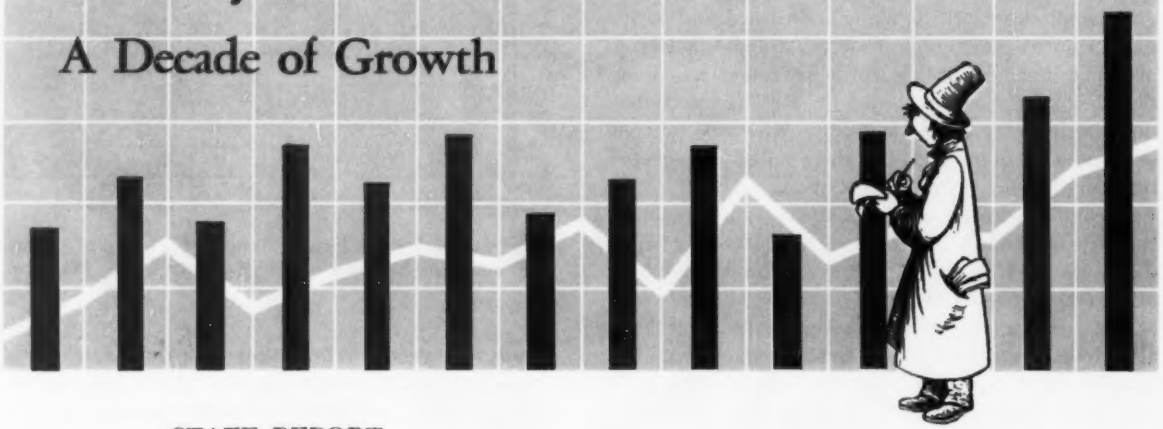
INCREASE IN VOLUME OF DEBT
(in billions of dollars)

	State & local	Corporate	Non-farm mortgage residential	Non-farm mortgage commercial*
1945	$13.7	$ 85.3	$ 17.7	$ 9.3
1950	20.7	142.1	42.9	16.5
1955	38.4	212.1	83.8	24.9
1958	50.9	255.7	111.8	32.8
1959	55.6	281.7	124.4	36.4

**Includes multi-family residential*

Survey Of The Profession... 1961

A Decade of Growth



STAFF REPORT

CE exclusive

TO MEASURE the growth of the profession is not easy. Even if an investigator were able to find the perfect sample of American consulting engineers, he would be hard put to think of just the right questions to ask them. Growth of firms cannot be measured in international units using calibrated instruments and standardized procedures. To some, a growing firm is one that is adding personnel; to others, it is one with a rising gross income; but the owners themselves are more likely to use net worth or net income as a yardstick. Nearly every firm able to continue in practice can find some direction in which it has grown. Therefore, to get a clear picture of growth, it is necessary that many questions be asked of many firms and that all their answers be fitted together.

To gather the data for this measurement of growth of the profession, CONSULTING ENGINEER sent a four-page questionnaire to every firm of consulting engineers on the circulation list, a total of 6213. Completed questionnaires were received from 2315, or slightly over 37 percent. So large a return constitutes a true survey rather than a simple statistical sample.

The questions were worded so that the answers could be punched into IBM cards; that is, the questions called for facts rather than opinion. This made it possible to sort mechanically and establish data which was uncolored by either the answerers' or the editors' opinions.

The survey provides, then, a study of growth from several points of view. It covers a decade, the '50s, and it provides excellent evidence of an expanding profession, more than keeping up with a generally expanding economy. However, in studying these figures it must be kept in mind that this survey had to be based only upon answers from those firms that have been successful enough to be in business today. There are some unfortunate firms that have failed during this decade past, and of these we know nothing. We are presenting here data on birth rate and growth patterns — but nothing on the death rate. It is obvious, however, to anyone at all familiar with private practice that most firm deaths are infant deaths. Firms are founded, flounder a year or so, and then die. These make little impression on the profile of the profession. It is, on the other hand, rare that a firm of any stature fails after it has reached maturity. To bring the small ghosts of these embryonic failures into the survey would be little more than an exercise in statistical scholasticism — an attempt to determine the number of nonexistent firms that could dance comfortably on the blunted point of a card sorting needle.

Age Groups

This is a survey of growth in the '50s. It examines conditions at the start, at midpoint, and at the end. Therefore, three answers were required for all questions; an answer for 1950; another for 1955; and, finally, for 1960. But all the firms answering the questionnaires were not of one age. Some were founded before 1950, some between 1950 and 1955, and others since 1955. Obviously, the firms founded since 1950 or since 1955 could not answer regarding their prenatal condition, so returns were sorted into the three groups shown in Fig. 1. Group A includes all firms founded before 1950, group B, those founded between 1950 and 1955, and group C, those founded since 1955.

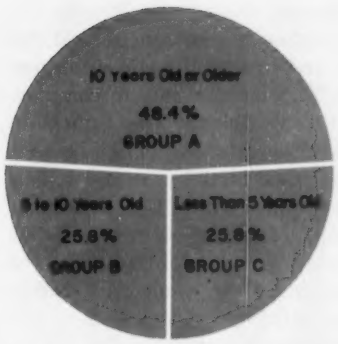


Fig. 1 — Firms divided by age group.

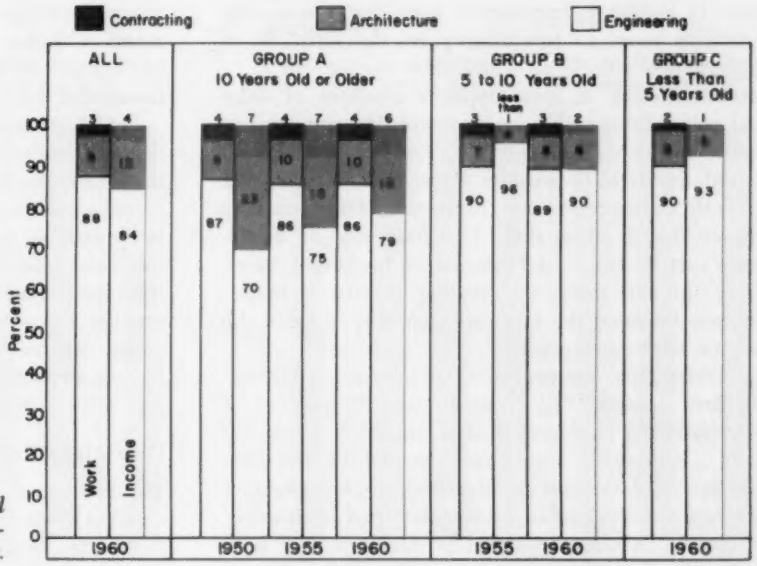


Fig. 2 — Percentage of work in, and income from, engineering, architectural, and contracting activities.

Note that just about half of the consulting engineer firms in the country were founded before 1950. About a quarter were founded in the first half of the '50s, and the remaining quarter got started in the last half. The niceness of these percentage figures simplifies the statistics of the study in a most satisfying manner.

Type of Firm, Type of Work

The firms surveyed are properly designated consulting engineers, but some of them do other types of work. If we lump together all the work done by all the firms and by all the groups studied, we come up with a breakdown of total firm activity into (1) engineering services, (2) architecture, and (3) contracting for construction. As shown in Fig. 2, the composite of all firms spends about 88 percent of its time in rendering engineering services, 9 percent in architectural activity, and 3 percent in construction work. Looking specifically at the three groups of old, middle age, and young firms, we find very little variation. There would appear to be a trend toward more architecture and more engineering and a slight decline in construction activity, but this is such a small shift that it can scarcely be termed significant. At the end of the decade, as at the beginning, the work done by the firms surveyed is nearly 90 percent engineering services. The percentage of construction activity of these firms has even shrunk slightly.

Fig. 2 also shows the percentage of total income from fees for engineering, architecture, and contracting. Here some startling facts come to light. First, with all firms taken together, current figures indicate that architecture and contracting produce relatively more income than engineering. For example, with 9 percent of the total work, architectural activities produce 12 percent of the net income. Engineering, with 88 percent of the work, comes up with only 84 percent of the income.

Notice, however, that this average for all firms includes opposing sets of data. Group A, the older firms seems to do very poorly on income from their engineering work. This group contains a heavy weighing of constructors (firms that do both engineering and construction) and engineer-architect firms. It must be inferred that many of these firms charge less than cost for engineering and make this up in their charges for architecture or construction. It seems that those who claim that independent consulting engineers are being subjected to unfair competition by firms that hide part of their engineering costs in architectural fees or construction contracts may be right. Surely it is unreasonable to believe that a group of firms can make a profit on engineering if, as was true of Group A in 1950, 87 percent of their work load was engineering but only 70 percent of their net income came from engineering fees.

Independent consulting engineers can take heart, however, in the knowledge that this ratio improved considerably during the '50s even for Group A, while Groups B and C seem to be getting income out of engineering about in relation to the work expended. As a matter of fact, it even looks as if there might be a slight tendency for very new firms of engineers to throw in a little architecture at less than cost as a come-on for clients. Note that when the B firms were first starting, five years or so ago, they devoted 7 percent of their effort to architecture and only got 4 percent of their income from architectural

fees. It is also interesting to note that the youngest firms seem to lose money on the little bit of construction activity in which they engage.

The outcome of these opposite positions of older and newer firms will make an interesting comparative study at the end of the '60s. Looked at today, it would appear to be wise for a new firm to steer clear of both architecture and contracting, but it can be argued that if a firm sticks to it long enough, the reverse can be true — at the cost of bucking a trend. Even the old firms are tending toward a proper balance between the type of work they do and the income they receive for it.

Turning from the profession as a whole to individual firm activity, Fig. 3 shows that 70 percent of the consulting engineers deal in engineering services only. Their spirits are never elevated by the contemplation of esthetic architectural elegance; neither are their nerves jangled by the clatter of contractors' equipment. About 23 percent of the firms offer both architectural and engineering services, while 7 percent might properly be called constructors, since they do both engineering and construction. An examination of the bars for Groups A, B, and C of Fig. 3 would indicate a slight increase in the number of architect-engineer firms, with a corresponding decrease in number of firms offering only engineering services. It is also worth noting that only in Group C of Fig. 3 does the total of the percentages add up to more than 100. This must mean that there is, for the first time, some measurable overlap of architecture and contracting. If this has significance, it seems that the architect-contractor may be just beginning to show his head over the foundation footings.

Fig. 4 deals only with the engineer-architect firms — those of the middle bars of Fig. 3. Today the engineer-architect firm is 6 parts engineer and 4 parts architect, and it can be seen that the trend is clearly toward an even dryer mixture. The reason is obvious. Buildings continued, during the '50s, to demand a higher and higher percentage of cost for mechanical, electrical, and structural engineering materials and equipment. This trend is sure to continue.

Fig. 5 presents data only for the few firms that do both engineering and construction. It can be seen that these firms divide their activity almost equally between the two activities. There is a noticeable jump in the percentage of engineering services in the new firms of Group C. Careful inspection of the returns shows that this is the result of a sizable number of new organizations that are largely engaged in consulting activity but who do just a little contracting on the side. They are, we might say, just a little pregnant.

How Many People

The number of people employed in a firm is one indication of size. And in a firm of consulting engineers, there are three categories to be considered. First there are the owners; next are the registered employees; then there are the technicians and general office help. To separate engineering employees on the sole basis of registration may not be entirely realistic at this moment, but it is becoming more so each year, and we have chosen to use it here.

Fig. 6 illustrates the number of owners, partners, and principals in a firm. Looking at the first bar, it can be seen that today, 1960, the average number of top men in a firm is 2.03, almost exactly two per firm. This is for all firms — old, middle, and young. Turning to those over 10 years old, it is clear that there has been a steady increase in the size of top management for these firms during the decade, from 1.71 in 1950 to 2.01 in 1955, to 2.26 in 1960. It might be said that the average older firm (Group A) has added ¼ of a man at the top every five years. (Some may feel that this is all too literally true.)

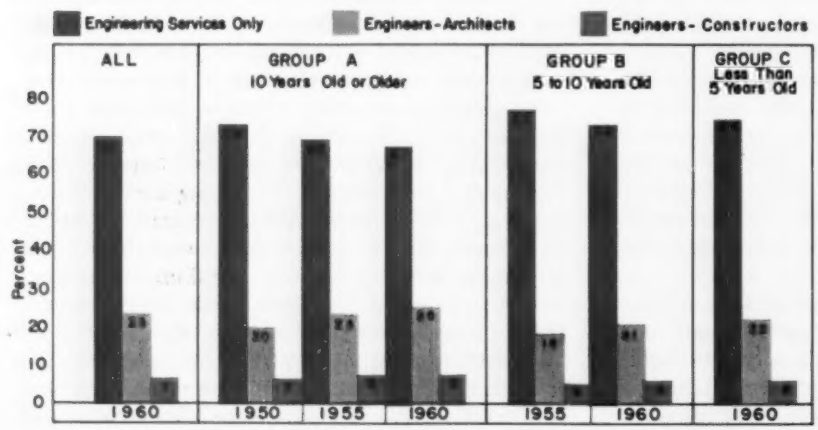


Fig. 3 — Percentage of firms engaged in engineering only, in engineering-architecture, and in engineering-contracting.

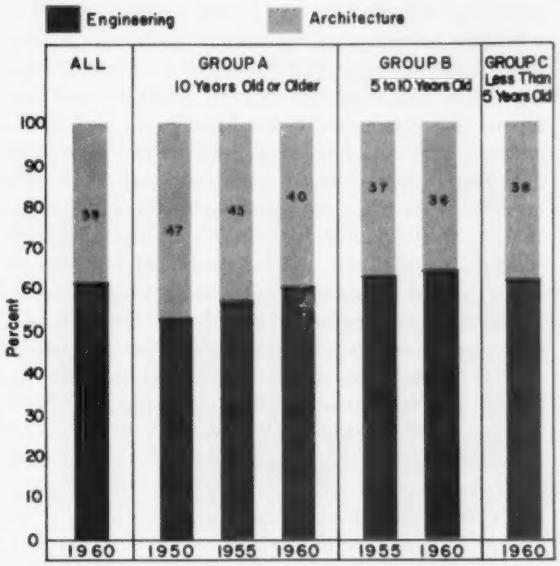


Fig. 4 – Breakdown of work by engineer-architect firms.

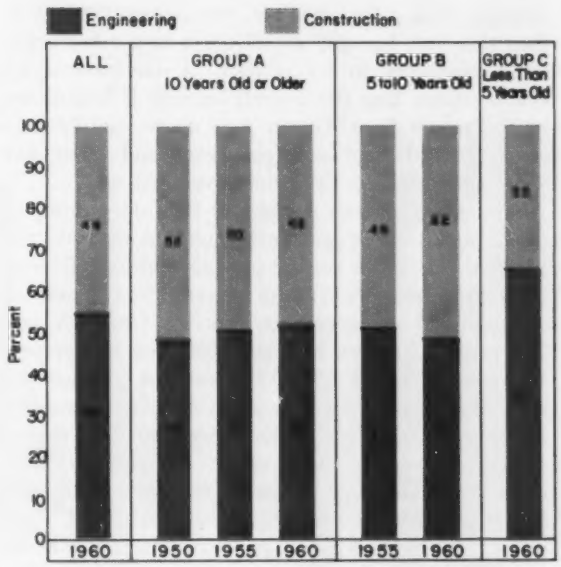


Fig. 5 – Breakdown of work by engineer-contractor firms.

A count of top management, however, is not a direct measure of growth. While the number of partners in a firm has been used by some associations as a basis for their dues formulas, it is generally acknowledged that no sure relationship exists between number of partners and size of firm. Some quite large firms are under sole ownership while some relatively small organizations are ruled by a surprisingly large consortium of partners. An increase in the number of partners in a firm is, however, indicative of increased breadth of activity. It is customary for a firm expanding into a new branch of engineering to take on a partner who is expert in that field. There is good reason to believe, therefore, that this increase in the number of partners is evidence of broader firm activity across the several branches of engineering.

Moving to Group B in Fig. 6, the same pattern is repeated for these middle age firms. They started with about the same number of partners that the older firms had at the beginning of the decade, and they too have added ¼ of a partner in five years. Group C, the young group, started again at 1.70, and if they follow the clear pattern of the '50s, their future can be plotted easily.

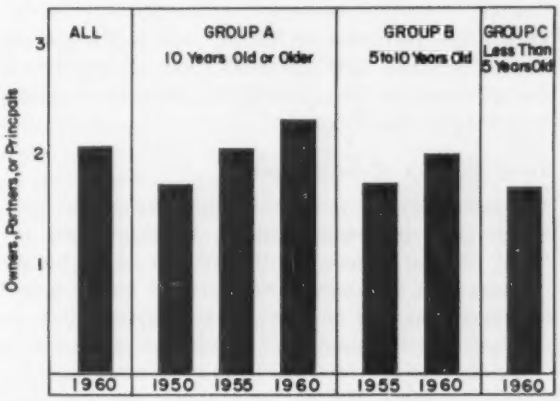


Fig. 6 – Average number of owners, partners, or principals.

Registered Engineers

Turning to Fig. 7, we see a picture of growth represented by the number of registered engineers in a firm. Today, the average firm, regardless of age, has 4.09 registered engineers. This includes all owners, partners, or principals who are registered. In fact, if we are to assume that both of the partners in the

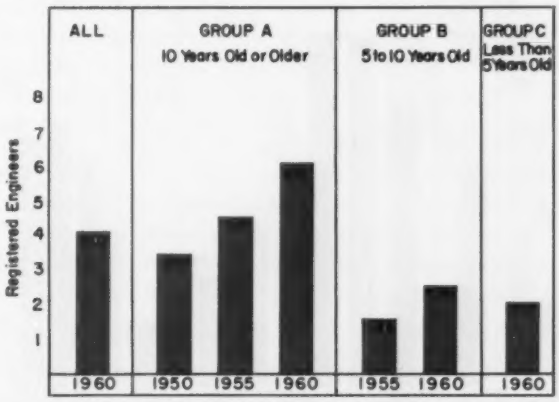


Fig. 7 –Average number of registered engineers per firm.

average firm (Fig. 6) are themselves registered, then this firm has just slightly over two other registered engineers in its employ. A comparison by groups shows that this overall average is held down by the newer firms. Group A is up to slightly over six registered engineers per firm, and even five years ago, back in 1955, they averaged 4½.

The strong growth pattern of this older group is interesting. Here is good evidence that the '50s was a growth period for private practice and for engineering registration. The rate of increase in the number of registered engineers per firm for Group A was 36.5 percent between 1950 and 1955, and 33.8 percent between 1955 and 1960. The rate of increase for registration in Group B is an even more impressive 56 percent, but they started lower, so they earned a high percentage more easily. Numerically, each older firm added 1.20 registered engineers in the first half of the decade and 1.52 in the second half. Each firm of Group B added .92 registered engineers in the second half.

Group C, the youngsters, today have a fairly healthy 2.05, a considerable improvement over Group B, who started with 1.64, which is even lower than their corresponding average of 1.72 partners (Fig. 6). This means that some of the top men in those firms formed between 1950 and 1955 were not registered, though this ratio was quickly and properly reversed in the following five years.

Total Number of Employees

An increase in the number in top management may simply indicate greater breadth of engineering activity, and an increase in the number of registered engineers per firm may partially reflect only a greater interest in and respect for registration, but an increase in total number of employees is a reliable indication of firm growth. Based on this yard stick, a healthy growth is demonstrated. Today the average firm of consulting engineers has 21.21 persons working for it, including the owners, partners, and principals. To summarize from Figs. 6, 7, and 8, this average firm has 2.03 registered engineer partners, 2.06 employee registered engineers, and 17.12 other employees, bringing the total up to the 21.21 shown in Fig. 8. It should be noted that the 17.12 employees includes not only nontechnical but also the nonregistered technical employees. Graduate and fully experienced engineers would fall into this general employee category unless they were registered.

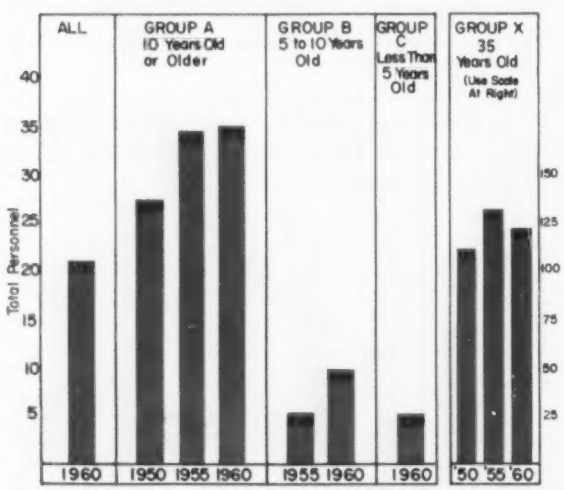


Fig. 8 — Total personnel per firm (including partners).

It is in the area of total personnel that we find the greatest variance between the firms of different age groups. The older firms, Group A, are distinctly larger than either the middle age or the young. Even 10 years ago, these older firms had larger staffs than the average firm does today, and both Group B and Group C look tiny in comparison. Looking at them simply as they are today, the older firms average 35.12 (of which 29.11 are nonregistered), against 9.96 for Group B (with 7.40 nonregistered), and just 6.39 for Group C (of which 4.34 are nonregistered). Note that the percentage of nonregistered personnel goes up rapidly for the older, larger firms. It takes a lot more clerks, draftsmen, and typists to support each registered engineer in the larger firms, and this might appear to be wasteful. It could be just the opposite. The large firms may be making better use of man power by using engineers only on highly technical work and assigning lower level activity to technicians and clerks. In the smaller firms it is essential that some of the less technical work be done by the engineers, for the volume is not great enough to hire supporting technicians, draftsmen, and clerks. In the one-man firm, the chiefs must also work like Indians — and sometimes even like squaws.

The older firms of Group A have shown a good pattern of growth through the '50s. From 26.97 to 34.21 in the first five years gives a growth rate of 26.8 percent. The continued growth to 35.12 in 1960 is at the considerably reduced rate of 2.7 percent. We see, then, that in the last half of the decade it was not the old firms that were growing in total personnel but the middle age and young. The middle age firms, Group B, jumped from 5.45 to 9.96, an increase of 83 percent. In fact, Group B's actual numerical growth of 4.51 is just about five times that of Group A. The youngest, Group C, has no earlier data for comparison, but it starts its history with a firm average of 6.39 total personnel, nearly one more person per firm than Group B had when it was getting started back in 1955.

In this area of total personnel, an additional study was made of a very elderly group of firms, Group X,

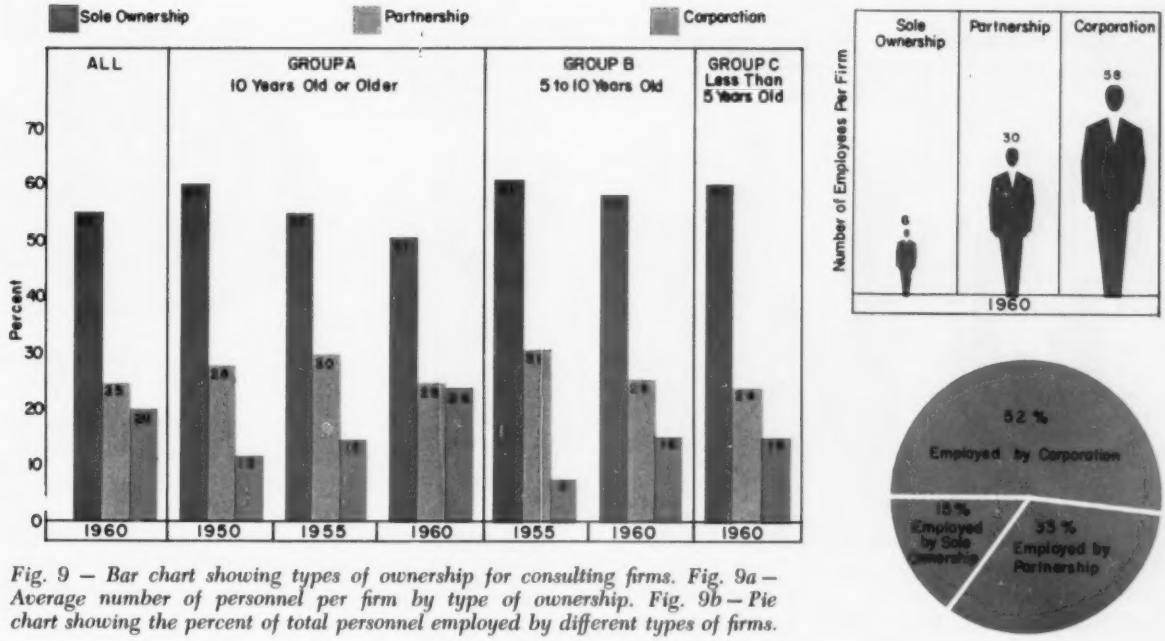


Fig. 9 — Bar chart showing types of ownership for consulting firms. Fig. 9a — Average number of personnel per firm by type of ownership. Fig. 9b — Pie chart showing the percent of total personnel employed by different types of firms.

all founded before 1925 (Fig. 8). This study shows the growth rate for a group of firms that had reached maturity long before 1950. These are large firms, about five times the average when measured by number of personnel. These large, old firms are the only ones that have gone both up and down during the decade. There are several reasonable explanations. One is the interstate highway program. Large, old firms tend to have much of their activity concentrated in public works, and it is natural that they should beflect its ups and downs.

There is also another explanation. A number of these older and larger firms, particularly in the Northeast, are obviously going into a decline. Their practices have suffered severe losses to younger, more active firms, particularly during the past five years. The decline of the ancients during a decade of general growth of the profession is a notable fact, regardless of cause.

The Trend to Corporate Structure

The survey shows (Fig. 9) that a majority of the firms offering engineering services to the public are operated as sole ownerships. A quarter are partnerships and a fifth are corporations. But it is necessary to leaven these figures with a grain of salt from Figs. 9a and 9b, which clearly show that the sole ownerships may be great in number but they are small in size. The average sole ownership has just 6 employees; the partnership has 30; and the corporation has an average personnel of 58. In fact, with only 20 percent of the firms, corporations employ 52 percent of the personnel. Partnerships account for 33 percent, while the sole ownerships, with more than half the total firms, employ only 15 percent.

An examination of the bars for Group A of Fig. 9 shows that there was a substantial trend toward corporate practice during the '50s. The percentage of corporations doubled, from 12 to 24 for this older group. Group B data confirms this trend, with a shift from 8 percent to 16 percent between 1955 and 1960. The C Group starts with 16 percent as corporations, which shows that an even higher percentage of the new firms are starting as corporations than did the older one of 5 to 10 years ago.

The increased precentage of corporations means a corresponding decrease in sole ownerships and partnerships, and while both show downward movements, the significant drop is in sole ownerships. Most new firms still start off as sole ownerships, but many of them turn quickly toward a corporate structure as they grow. This is meaningful, since the most pressing reason for incorporating is to avoid excessive taxation on personal income. The fact that many firms shift during their early years to corporate practice is indicative of considerable financial success. While individual situations vary, it is at the $25,000 personal income level that a sole owner or partner starts to investigate the tax advantages of incorporation.

Geographical Growth

Having studied growth as measured by increased personnel, it is interesting to turn the stone and have a look at another facet, geographical expansion. As

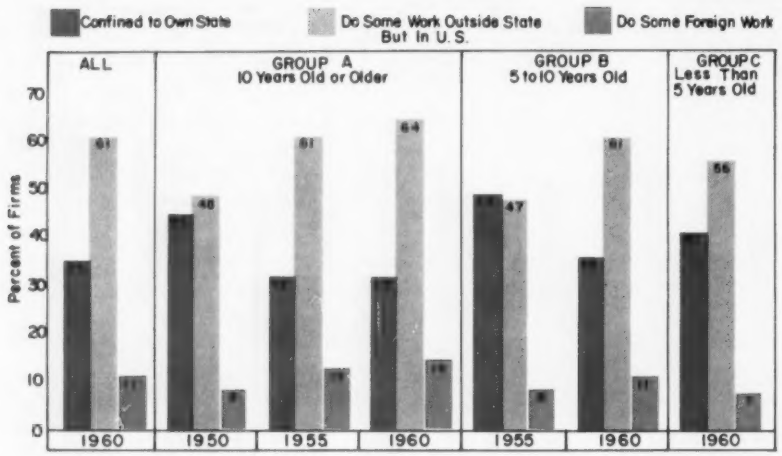


Fig. 10 — Geographical limitations on the consulting firm's practice.

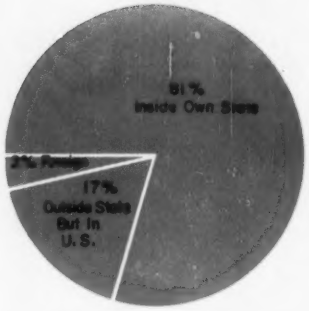


Fig. 11 — Geographical origin of 1960 engineering workload.

would be expected, firms expand their areas of operation as they age and get bigger. Small firms, that start with local projects only, begin to feel confined and look for work from further away. Some start looking abroad. This is not simply a matter of the shade of the grass in far fields. Rather, it is due to saturation of local markets, or political conditions that may make local clients too hard to work with. There are, in fact, many reasons for a firm to start looking for work outside its own immediate area, not the least of which is a healthy spirit of adventure or even an idealistic dedication to man's material progress.

Whatever the cause, each year during the '50s more engineering firms moved into interstate and foreign work, leaving fewer whose work was strictly local. Currently, 35 percent of the firms confine their work to their own state; 61 percent do some work outside their state but in the U. S.; and 11 percent do some foreign work (see Fig. 10). There is some overlap, of course, in the 61 percent that do interstate and the 11 percent that do foreign work. To say better than one firm in 10 does some foreign work may sound high, but it must be recalled that Canada, Mexico, Cuba, and the West Indies are all "foreign."

In this matter of geographical expansion, an examination of Groups A, B, and C is particularly interesting. Note that Group A, the older group of generally larger firms changed distinctly during the decade. In 1950 about 44 percent of these firms worked only within their states; 10 years later this dropped to 32 percent, while in contrast, those that did some interstate work rose from 48 percent to 64 percent. Group B produced a similar pattern between 1955 and 1960. Group C, the recently formed firms, simply started with a less provincial practice than their older colleagues.

There has been a discernible and probably significant increase in the number of firms that do some work abroad, but a look at Fig. 11 (which shows that foreign work accounts for only 2 percent of the total) makes it clear that, regardless of the increased number of firms involved, the volume of foreign business is relatively small. Many of the firms involved in foreign work actually do very little. Almost two-thirds of these firms get less than 10 percent of their work from foreign countries. However, the average firm, of those that have some foreign practice, gets 21 percent of its work outside the U. S.

Despite the fact that 81 percent of the total engineering work still comes from inside the engi-

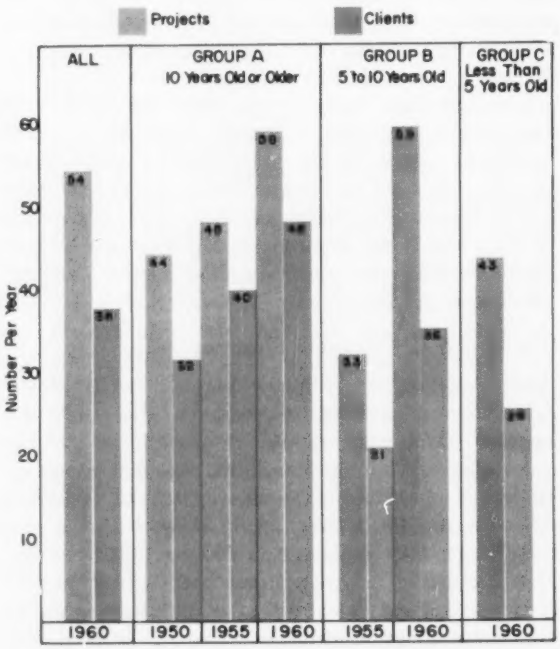


Fig. 12 — Number of projects and clients annually.

neer's own state, it is obvious that consulting engineers are expanding their territories. Fewer each year are provincial practitioners. This is a notable trend of the '50s, and it is likely to accelerate in the '60s.

How Many Projects?

As illustrated in Fig. 12, the average consulting engineer firm currently handles 54 projects a year. The older firms are handling 58 a year, which matches almost exactly the 59 a year of the middle-aged firms, while the younger firms are active on only 43. It is reasonable to assume, however, that the 58 projects of the older firms are 58 relatively large projects, while those of the other groups, particularly of the C Group, are smaller. (Later articles will take up income, value of projects, and related topics.)

Alongside the bars representing number of projects (Fig. 12) are corresponding bars for number of clients. There are, today, an average of about 1.2 projects per client. Checking the separate groups, we find that while Group B and Group C both have a project to client ratio of 1.7 to 1, the older firms of Group A have a 1.2 to 1 ratio. This simply means that the younger firms tend to handle more but smaller projects per year for the same clients.

It is interesting to combine the data of Figs. 6, 7, and 8 with those of Fig. 12. Knowing how many clients each group deals with each year, it is possible to compare this with the number and type of personnel serving those clients. Taking all firms together, each partner must take care of 19 clients, but there are 9.5 clients per registered engineer in his firm and 1.8 clients per employee. According to this, client relations should be twice as difficult as employee relations.

When this is examined by groups, it turns out that each partner in Group A must deal with 21 clients, each partner of Group B with 18 clients, and each partner in the younger firms with 15 clients. A different pattern is followed for registered engineers and total personnel:

	Clients per Partner	Clients per Registered Engineer	Clients per Employee
Group A	21	8	1.4
Group B	18	14	3.6
Group C	15	13	4.0
All	19	9.5	1.8

This indicates that, even at best, client contact frequently must be neglected. In the young, small firm, it must be difficult for slightly less than two busy partners to give the necessary personal attention to about 26 different clients. It is obviously impossible for the slightly more than two partners of each older firm to handle nearly 50 clients a year on a personal contact basis. We can assume, then, that client contact in the older firms must be partially delegated to other than partners. To balance this, these older firms offer more registered engineers and more total staff members per client than do the younger firms.

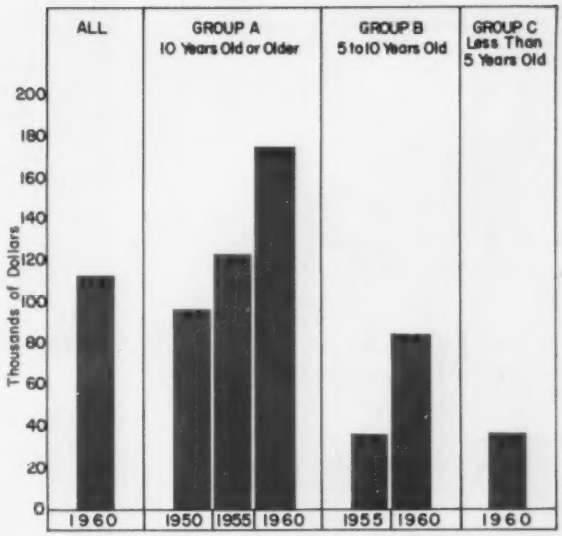


Fig. 13 — Present net worth of the consulting firms.

Finally, Net Worth

The final measure of growth of a firm must be based on net worth. Here the picture is a good one. Lumping all firms together, the average consulting engineer firm today has a net worth of $113,000. This is a rather healthy figure for a firm that has a total personnel of only 21 and usually owns little more than a few desks and drafting tables. Even more impressive is the growth rate during the decade. The older firms of Group A had a net worth of $97,000 in 1950 and managed to raise this to $175,000 by 1960. This is an increase of 80 percent — nothing to be ashamed of. The middle-aged firms of Group B went from a net worth of $37,000 in 1955 to $94,000 in 1960. This is a rosy 154 percent increase in five years. Group C should do so good!

While consulting engineers cannot yet be pointed out as a financially favored elite, the engineer who got together with another engineer something over five years ago and kicked in about $18,000 in begged or borrowed money to form an engineering firm now has better than $2.50 for each $1.00 he invested. And we must presume that during these few years he also has been able to earn a reasonably decent living.

The private practice of engineering is not only a respected profession, it is a good investment — or it was in the 50's. ▲▲

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MILO S. KETCHUM
Ketchum, Konkel & Hastings

THE FOLDED PLATE is the simplest of the shell structures. It is easy to design, and its plane surfaces usually give the builder little trouble in forming and pouring. It is more adaptable to small areas than are the curved surfaces, which for maximum economy require the re-use of the complex forms over and over. A folded plate can be formed for about the same cost as a horizontal slab, yet it requires much less steel and concrete for the same span.

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Basic Elements

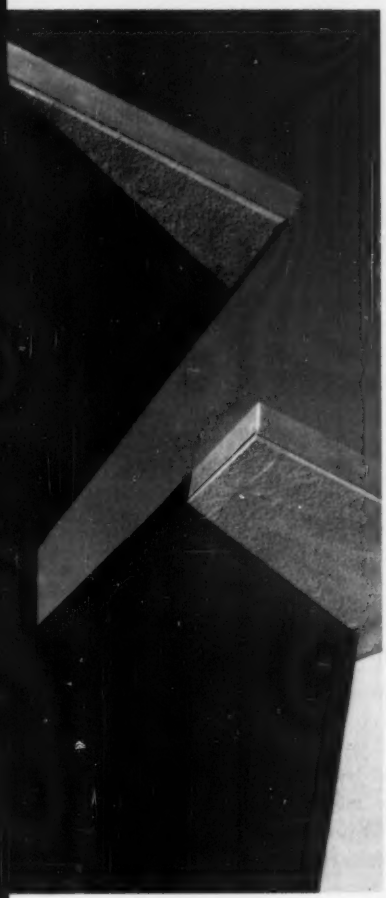
The principal components of a folded plate structure (Fig. 1) are: (a) the inclined plates; (b) the edge plates, which are used as stiffeners for the wide plates; (c) the end stiffeners to carry the loads to the supports and to hold the plates in line; and (d) the columns to support the structure. The span of the structure is the greater distance between columns, while the bay width is the distance between similar structural units. A strip across a folded plate from the crown to the valley is called a slab element because the plate is designed as a slab in that direction.

The structure illustrated in Fig. 1 is a two segment folded plate. If several units are placed side by side, the edge plates generally are omitted from all but the outside edges. If edge plates are used on inside edges, the design is called a two segment folded plate with a common edge plate.

A structure may be designed with a simple span or with multiple spans of varying length. The folded plate also may be cantilevered from the supports, without a stiffener at the end. Folded plates are not suited to wide bay spacings. For widths of plate over about 12 feet, the folded plate must be made thicker than a barrel vault. Increasing the thickness of the slab at the valleys and at the crown, as shown in the sectional view in Fig. 2, is of some advantage, permitting an increased span with less material.

Three Segment Folded Plate

Fig. 3 shows a folded plate structure with three segments, (a), (b), and (c), for each barrel. The end stiffeners (d) are rigid frames rather than deep girders as in Fig. 1. The forces from the reactions of the sloping plates on these rigid frames will be quite large,



Architectural effect of a Z shell can be dramatic, especially if it cantilevers beyond supports.

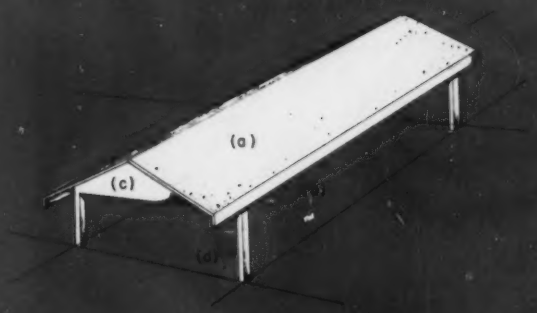


Fig. 1 — Elements of folded plate structure: (a) inclined plates, (b) edge plates, (c) end stiffeners, (d) columns.

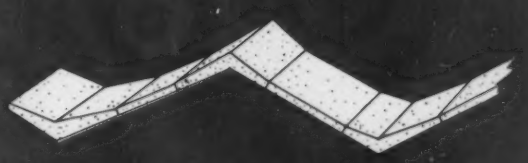


Fig. 2 — Increasing the slab thickness at valleys and crowns permits an increased span with less material.

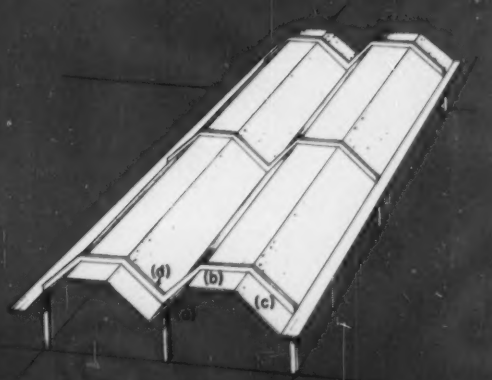


Fig. 3 — Three segment folded plate. Dimensions are for a structure with 60-ft span and 24-ft bay width.

and at an outside column there are no adjacent plates to balance this thrust. The size of the frames required to resist these forces may be reduced, however, by incorporating a steel tie between the tops of the columns in the design of the structure.

The dimensions of the plates depend on the width of the bay and on the length of the span. The depth of the shell (h) should be about one-tenth the span, and the maximum slope of the plate should be no greater than 40 degrees. For example, if the span is 60 feet and the bay width is 24 feet, the depth of the shell should be about 6 feet and the horizontal width of each plate of a three segment plate should be about 8 feet. The slope of the plates is 8 horizontal to 6 vertical, which is about 37 degrees. The thickness of the plates should be about 3½ inches.

The Z Shell

A Z shell (Fig. 4) is made up of one large sloping plate (a) and two smaller edge plates (b). These are arranged so as to provide a space between the units for fenestration running the full length of the structure. The architectural effect of the shell design can be

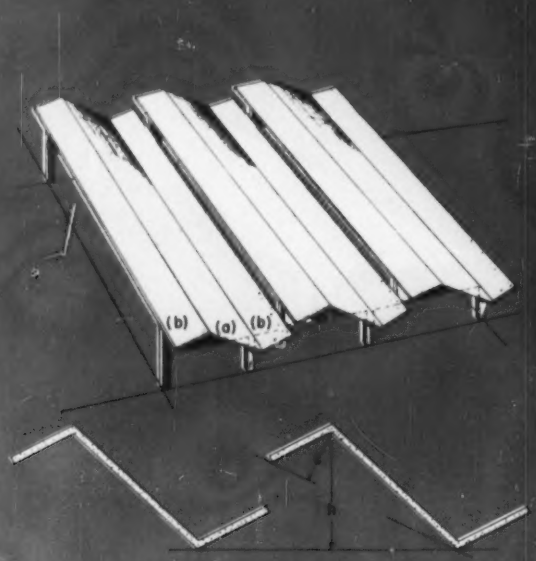


Fig. 4 — The Z shell is formed of three sloping plates. This discontinuous form is inefficient.

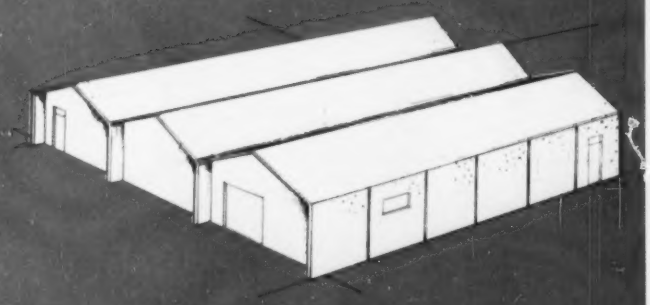


Fig. 5 — Building with tilt up walls made continuous by roof plate. The walls act as vertical beams.

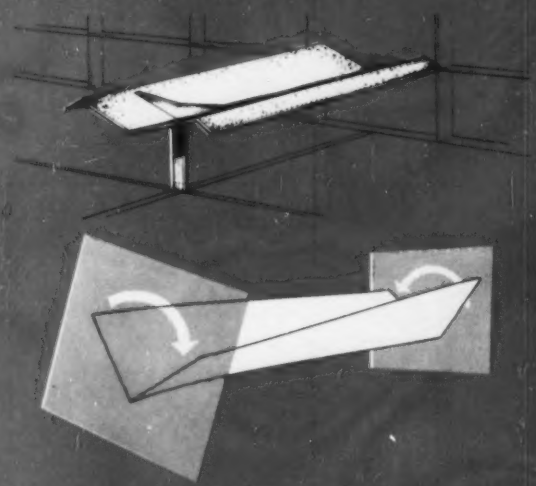


Fig. 6 — Small canopy in the form of a four segment plate, far superior to a two segment plate.

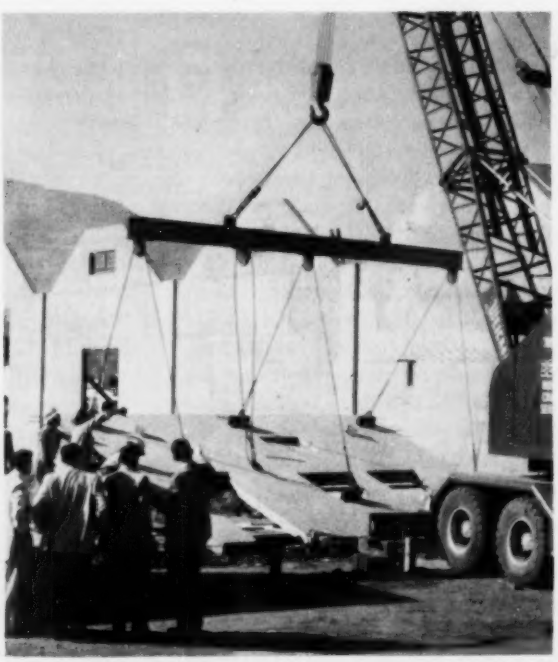
dramatic, especially when there is a cantilever projection of the slab beyond the supports. The windows normally face the north, but most of the light actually is reflected southern light. To increase this reflection the roof can be covered with aluminum or painted so that sunlight is reflected through the windows to the interior of the building. These windows need not be large. Adjacent units are tied together with structural window mullions.

In constructing the Z shell, movable forms need only be lowered a short vertical distance if, in the arrangement illustrated, construction is started on the right side and then proceeds to the left for each successive unit in the structure.

The Z shell is not an efficient structural shape, since it is discontinuous. Furthermore, its effective design depth (c) is much less than its actual vertical depth (h), as shown in the sectional view in the lower part of Fig. 4. Therefore, spans with these shells must be shorter than for shells designed with units that balance their thrusts where they meet.

Walls Continuous With Shell

Fig. 5 shows a structure with walls of tilt-up concrete construction. The concrete for the walls is cast flat on the floor and then raised into place with cranes. Tilt-up walls usually are joined by poured-in-place columns, and in this design they are made continuous by the roof plates. Columns are not always necessary at the junction of the wall panels, for the walls are sufficient-



A crane is used to tilt up pre-cast concrete wall sections.

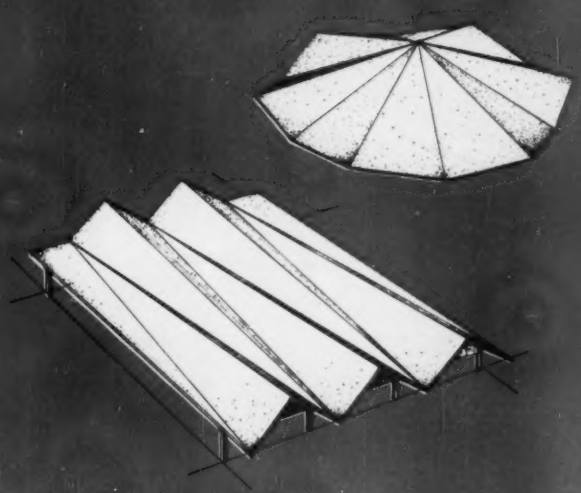


Fig. 7 – Roofs with combinations of tapered folded plates.

Fig. 8 – Edge supported plates on a series of columns.

ly braced at the top. Only a simple, grouted key slot may be provided.

The tilt-up panels can serve as their own foundation walls, so a continuous footing pad is used, with a notch to receive the tilt-up panel. Interior floors of dock height can be constructed by filling the interior of the building with dirt to the required depth. The tilt-up walls can be designed to resist this lateral load, since they are held at the top by the shell and act, therefore, as vertical beams rather than as cantilevers.

Canopies

A folded plate will serve excellently as a small canopy at the entrance of a building. The folded plate shown

Cantilevered Z shell roof of a Kansas City high school.

Two segment folded plate roof for Colorado Federal Bank.

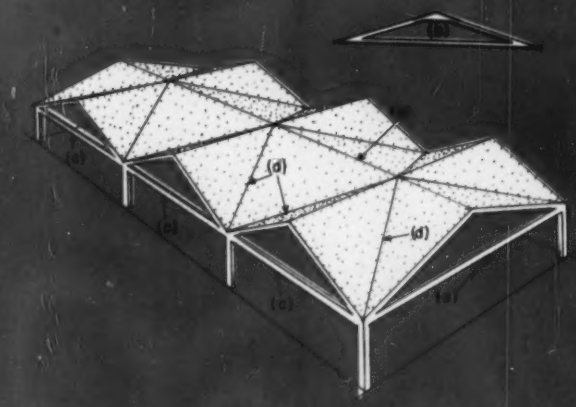


Fig. 9 — The folded plate truss, a true "space structure."

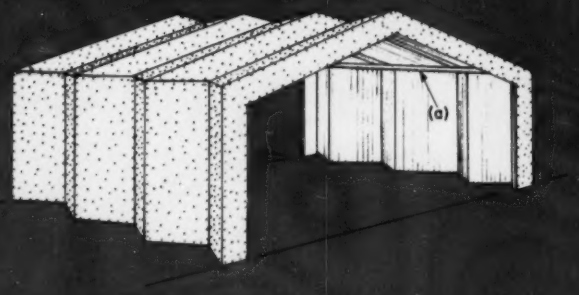


Fig. 10 — Folded plate walls, roof in rigid frame building.

in Fig. 6 has four segments. A two segment structure is undesirable because it has very little torsional resistance. This instability can be demonstrated with a model made of a folded piece of paper pasted to cardboard stiffening members at each end.

If it is necessary to have a two segment structure, a torsion member should be placed in the valley to resist any torque. Stiffeners sometimes can be hidden on the top surface, and the shell will appear to spring from the vertical column. Where the canopy starts at the wall of the building there should be a stiffener hidden in the wall construction.

Provision also must be made in the design for drainage of the center valley.

Tapered Folded Plates

Folded plate structures can be designed with tapered elements. Two of the many possible combinations are shown in Fig. 7. Note that when the smaller depths are all at one end, the entire structure becomes circular. The height of the shells at the center of the span is the critical dimension for determination of bending strength. Therefore, the structure is not efficient and is not suited to long spans unless considerable height is provided at the large ends. The transfer of shear from the small end of the triangular plate to the large end is another weakness of the design. If a large number of units are used in each span, the transfer of loads may be difficult.

Edge Supported Folded Plates

The usual edge plate can be eliminated and the roof structure can be made to appear very thin if a series of columns are used as shown in Fig. 8, where edge supported folded plates are used. The roof slab between side columns must be designed as a beam. If desired, the roof slab can be extended as a cantilever canopy. Then the beam element that carries the load of the roof between columns will be wider, and windows under the slab will have some sun protection. Note the vertical columns in the end walls at the crown of the gable. These take the reactions of the plates, and the horizontal ties are eliminated. Wind loads are resisted by rigid frame action in the columns and stiffeners.

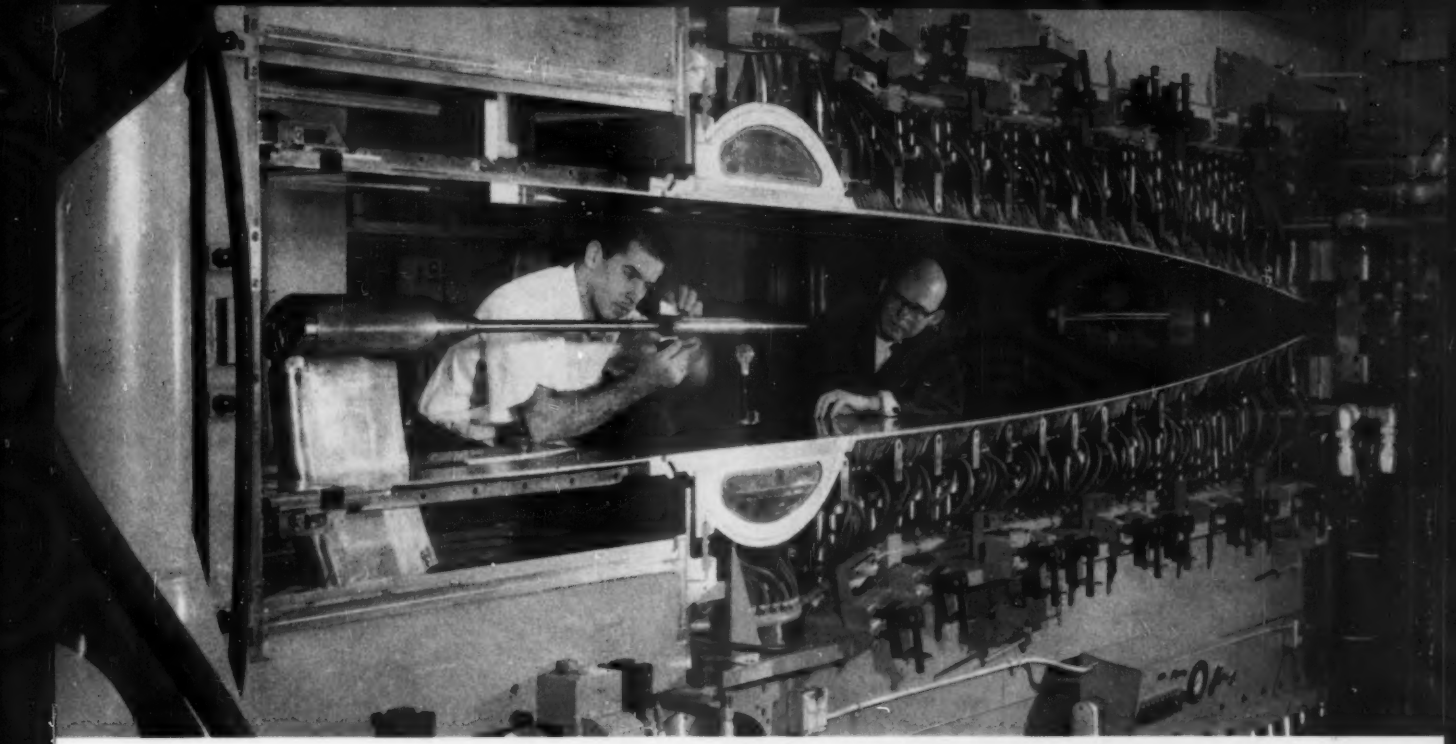
Folded Plate Truss

The term "folded plate truss" is indicative of the structural action of the design shown in Fig. 9. There are horizontal ties (a) only across the ends of the building, and the structure, like that of Fig. 8, acts as an edge supported shell. The thrusts from the triangular crossed arches are carried lengthwise to the ends. The top chord (b) of the inclined truss is formed by the ridge member. The bottom chords (c) are the ties at the base of the side gables, and the diagonals (d) are formed by the sloping valleys at the intersection of the arches and the truss plates. The ridge member (b) may require some additional thickness to handle the compression forces.

This is truly a space structure, and its structural action is not as obvious as is that of simpler folded plate structures. The architectural appearance is more subtle.

Folded Plate Rigid Frame

Fig. 10 shows a building with folded plate roof and walls. Each plate is cast flat on the ground, lifted into place, and the grouted at the joints. A wall of this type can be made much thinner than a conventional flat wall. An arch with straight segments, a rigid frame, is not as efficient as a curved arch because the bending moments are greater. Ties (a) across the plates are required at the knees and at the crown to distribute the forces at the ends of each segment. ▲▲



Upstream view of the hypersonic wind tunnel in the Jet Propulsion Laboratory at the California Institute of Technology.

Wind Tunnels Go Hypersonic

CHARLES J. HELIN
Consulting Engineer

PRIOR TO THE INTEREST in transonic flight, wind tunnels were relatively simple, consisting of a closed air loop with a propeller fan on one side and a test section on the other. Usually a heat exchanger was incorporated, and sometimes an opening was provided at one point in the loop to stabilize internal pressure. The power requirements were large, but not prohibitively so. For instance, the 10-ft square tunnel at California Institute of Technology, which was placed in service about 1930 and is still in use, is equipped with a 500-hp motor and can generate speeds in the vicinity of 400 mph.

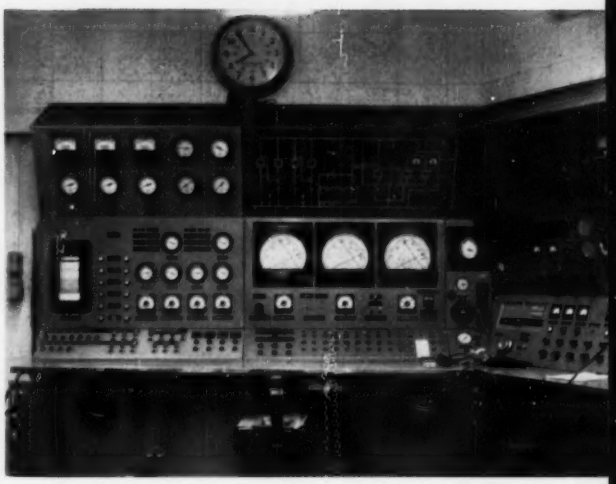
The problem with such tunnels is not so much the source of power as it is the adaptation of variable speed drives for the main fan, even for those tunnels with variable pitch propellers. For the higher class tunnels, a Ward-Leonard d.c. system is the most common and most versatile. Other systems use wound-rotor a.c. motors, and occasionally variable pitch belt drives are adequate for small experimental tunnels. Gasoline engines also have been used, but lack of precise speed control, noise, vibration, and relatively short life have limited their application.

POWER REQUIREMENTS INCREASED enormously when it became necessary to generate winds in the transonic and supersonic range. For the most part, large test sections capable of holding full scale models were abandoned. The ultimate in transonic tunnels of the continuous flow type probably was reached in an installation at the Arnold Air Force Base, in Tullahoma, Tennessee. This facility, planned in 1948 and completed in 1954, has a test section 16-ft square. The drive consists of two, 25,000-hp induction motors and two, 83,000-hp synchronous motors, arranged so that the entire 216,000-hp drives a single shaft. In starting, the induction motors are connected across the line with full rotor resistance in the circuit. As the speed increases, water rheostats are used to reduce the resistance, until the rotating element is close enough to rated speed to connect the synchronous motors. This accelerating procedure takes about seven minutes. The cost of this installation, its inability to gen-

erate speeds appreciably greater t[illegible] Mach 1, and the limited number of places in the world that can deliver the necessary power on demand have discouraged attempts to build any to compete with it.

During the period from 1946 to 1954, a number of continuous flow type supersonic tunnels were built using moderate size test sections – about 2-ft square. These generate speeds in the range of Mach 4 and are of such size that 8000- to 12,000-hp is adequate to run them. Such tunnels, equipped with variable nozzles for setting speed and ready provision for model change, can operate many hours per day and produce reams of test data. This in turn provides a good load factor for the power lines and, inasmuch as synchronous motors normally are used, a good power factor.

However, since these tunnels are expensive and the test sections limited, private concerns requiring test data in the supersonic and hypersonic range have resorted to blow down tunnels.

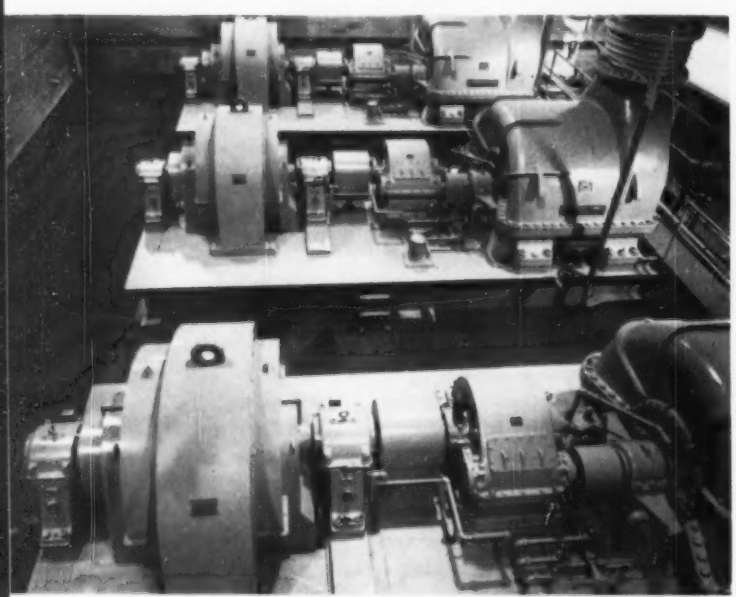


Control panel for a 20" supersonic wind tunnel at Caltech.

THE BLOW DOWN TUNNEL uses a large storage tank, pumped up to high pressure, as the source of air. Usually an ejector is added downstream to increase the pressure differential across the test section, with a valve to modulate the rate of air flow.

In this type of tunnel the power requirements bear only an incidental relationship to the tunnel speed, but a very direct relationship to the frequency of operation, as the normal test period is only from 30 to 60 seconds. Basically, the compressors operate like any plant air system; their job is to maintain air pressure in the storage tanks. When frequent runs are contemplated, the compressors are idled between the time the tanks are filled and the time of the run. If the waiting period exceeds an hour, they may be shut down until ready for another run.

An intelligent study of power requirements will show which components will provide optimum load and power factors – and consequently lowest energy cost. It becomes a matter of balancing first cost against the cost of the interval between runs. If frequent model and nozzle changes are contemplated, the pump-up time should be short. This requires relatively large compressors. For more widely spaced runs, smaller compressors probably will serve the purpose. A typical installation for a 4-ft square test section in a blow-down tunnel might require a compressor plant of 8000- to 10,000-hp to produce speeds up to Mach 5 with a 40-second run and a 40-minute pump-up time.



Part of compressor arrangement at Caltech's wind tunnel.

CONTINUOUS FLOW TUNNELS can be designed, of course, to provide higher Mach numbers; several have been built. But as the demand for speed increases, the test section size decreases, and the cost mounts rapidly. In several instances existing continuous flow systems have been modified by adding higher speed tunnels and topping compressors to boost the pressure. In this way Mach numbers of up to 10 or 12 are practical at moderate cost over and above the original cost of the lower speed tunnel.

A similar procedure can be used to increase the speed available on a blow-down tunnel. The addition of a topping compressor to boost the storage tank pressure to a higher level in a new and heavier tank can be the source for a hypersonic blow-down tunnel. Here again, high cost limits the procedure.

Temperature is another problem in the design of hypersonic tunnels. It is necessary to superheat the

air entering the nozzle to assure a high enough temperature in the test section to prevent condensation shock in the air stream. Electric heating has been used for this purpose, and since the load is highly intermittent (particularly with a blow-down tunnel), the result is a poor load factor and power rate situation.

THE PRESENT TREND toward testing at higher and higher Mach numbers has sharply increased the problems of higher inlet temperatures and pressures. As a result, several new methods of producing high test section velocities are being studied.

¶ One method is to ignite a charge of air and fuel in a pressure chamber; the resultant chamber full of hot gas at high pressure then can be directed down the nozzle. This method, however, has two disadvantages. It is difficult to obtain precise control, and the media in the tunnel is not pure air.

¶ A second method is the hot-shot tunnel, so called because a large amount of energy in the form of an electric arc is discharged into a pressure chamber filled with air at moderate pressure. The resultant again is a chamber full of hot high pressure gas (air this time) which ruptures a diaphragm and is relieved through the nozzle and test section. In this installation, a bank of capacitors is charged over a period of time and quickly discharged in the chamber, raising the air pressure from 2000 to 30,000 lbs and the temperature to 14,000 F. Running time is approximately 1/10 second. Velocity in the test section is Mach 27.

¶ A third system, called the plasma jet tunnel, uses a continuous electric arc in a high pressure air stream. The energy of the arc, which may be the entire output of a good sized transformer, is used to heat the air and thereby add to the ultimate velocity. Since this process ionizes the air, an ion accelerator can be employed downstream to increase the speed in the test section. However, unless carefully controlled, the arc will contain metallic particles and may become a metallic arc rather than an air arc. This third method is becoming increasingly important because it offers a convenient system of generating a continuous flow of high temperature, high speed air. Speeds of Mach 12 and temperature of 15,000 F are possible in very small test sections, but only for extremely short periods of time.

RAPID TECHNOLOGICAL DEVELOPMENT makes it necessary to figure on a rapid amortization of equipment – usually in the vicinity of five years – and operating costs also must be kept as low as possible. The choice of supply voltage should be made for minimum motor and switchgear costs and use should be scheduled so that the utility demand charges will not be too high. A study is required, therefore, to determine operating hours and demand loading, along with power factor and other conditions. It may be necessary to establish operating schedules coordinated with other plant or community loads, in the event the demand is greater than the serving utility can supply readily. At times it has been necessary for a utility to schedule another turbine on the line when a local wind tunnel is to be operated at full capacity.

Heater used in the 21" hypersonic wind tunnel at Caltech.

BECAUSE OF THE LARGE amounts of energy involved and the nature of many of the components, the potential hazards to personnel and equipment from errors or breakdowns are of great concern. A large number of interlock and annunciation circuits must be installed, not only to insure that the proper sequence of starting and stopping is followed, but also to detect immediately a malfunction of any portion of the system and automatically shut down the operation. With the large number of parts required to simulate various conditions and the high pressures and temperatures used, the number of interlocks is enormous, and it becomes extremely difficult to operate the tunnel. The control and interlock circuitry must be worked out carefully and methodically, so that interlock malfunctioning can be identified and corrected. The reliability of components must be of the highest order if the tunnel is to be operated economically and successfully on a regular schedule. ▲▲

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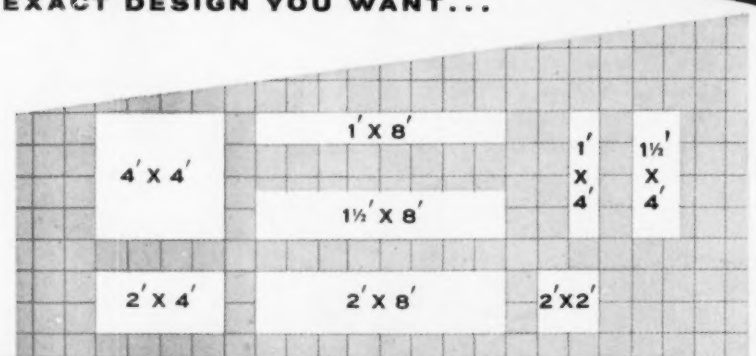

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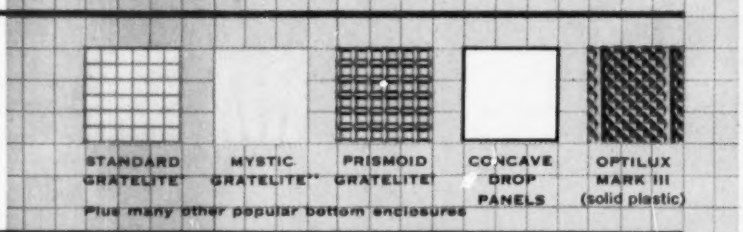

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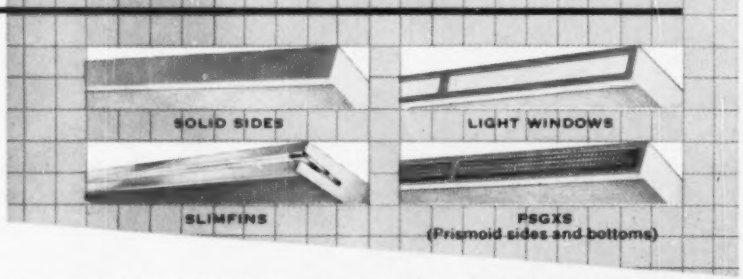

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Internal Revenue Code...

Changes and New Rulings

CARL H. RISTAU, C.P.A.

WHILE THERE was no complete revision of the Internal Revenue Code during this past year, there were numerous changes, providing new tax treatment for special types of taxpayers, as well as new rules which are applicable to taxpayers in general.

First, changes which affect the taxpayer's business deductions:

¶ Double Deductions – Several states have enacted legislation changing the date on which taxpayers become unconditionally liable for real estate taxes, enabling accrual basis taxpayers to deduct two years' taxes in one year. Beginning in 1961, these double deductions will be disallowed. The tax will be treated as accruing at the time it would have accrued had there been no change by the taxing unit.

¶ Accrued Vacation Pay – Those employers who have been consistently accruing vacation pay in advance under the old rule may continue to do so for taxable years ending before January 1, 1963. The old rule requires that the liability for vacation pay need only be fixed generally; the new rule will require that a specific liability must be determined.

¶ Travel and Entertainment – Congress did not pass any specific new law on travel and entertainment, but there were several rather drastic measures proposed. The legislators ordered a study and report by the Treasury Department and the Joint Committee on Internal Revenue Taxation on the subject of entertainment expense deductions. The reports are to be submitted as soon as practicable to the 87th Congress, and are to include recommendations for changes in the law or administrative practices, if they are considered necessary or appropriate.

Presently, agents of the Treasury Department are required to prepare an extensive questionnaire regarding entertainment practices of the taxpayers they are examining. Also, the 1960 Income Tax Returns, whether for individuals, partnerships, or corporations, request specific expense account information. Table 1 quotes from Schedule C – Profit (or loss) from Business or Profession (Individual Form 1040). This question, similarly worded, will also be found on partnership and corporate Federal tax returns for 1960.

In addition, those operating their business in the form of a sole proprietorship will find this request on their Schedule C:

"Enter information with regard to yourself and your five highest paid employees. In determining the five highest paid employees, expense account allowances must be added to their salaries and wages. However, the information need not be submitted for any employee for whom the combined amount is less than $10,000, or for yourself if your expense account allowance plus line 23, above, is less than $10,000. See instructions page 2 . . ."

The line 23 referred to is the net profit or loss from the business operation. The instructions define expense account to mean – "(a) amounts, other than compensation, received as advances or reimbursements, and (b) amounts paid by or for you for expenses incurred by or on behalf of yourself or your employees including all amounts charged through any type of credit

TABLE 1

EXCERPT FROM SCHEDULE — INDIVIDUAL FORM 1040

"Did you claim a deduction for expenses connected with: (If answer to any question is 'Yes,' check applicable box within that question.)

D. A hunting lodge ( ), working ranch or farm ( ), fishing camp ( ), resort property ( ), pleasure boat or yacht ( ), or other similar facility ( )? (Other than where the operation of the facility was your principal business.)

E. Vacations for owner or employees, or members of their families ( )? (Other than vacation pay reported on Form W-2.)

F. The leasing, renting, or ownership of a hotel room or suite ( ), apartment ( ), or other dwelling ( ), which was used by you, your customers, employees, or members of their families ( )? (Other than use by yourself or employees while in travel status.)

G. The attendance of members of your family or your employees' families at conventions or business meetings ( )?"

card, for which a deduction is claimed in this schedule."

Partnership forms require disclosure of expense account allowances for partners, and corporate forms require the same for officers.

Whether this all is a part of the Treasury's attempt to secure data for the study requested by Congress is conjecture. It is, however, a fact that Revenue Agents are presently requiring more proof to support entertainment deductions.

Employers, partners, and corporate officers should keep very detailed records of the why, who, and wherefore of all entertainment deductions, whether paid by personal check, credit card, or cash. Also, they should keep a diary and note pertinent facts relative to the expenditure on backs of credit slips, receipts, etc. The same should be required of employees. Adequate records may prevent remedial legislation that will make matters worse. The provision setting up the study mentioned earlier was a substitute for a Senate Amendment which would have limited entertainment deductions of expenditures for food, drink, and gifts to $10 per person per year.

Changes which affect personal rather than business deductions:

¶ Care of Dependent Parents — The Code has previously allowed cost of medical care for dependent parents to be included with other medical expenses the taxpayers may have paid during the year, but the total so expended was limited to the excess of 3 percent of the taxpayer's gross income. All medical expenses, except medicine and drugs, for a dependent father or mother of either spouse may be deducted, providing such dependent is past 65 years of age by the end of the taxable year. Medicines and drugs are still to be taken into account only if they exceed 1 percent of adjusted gross income.

¶ Students in the Home — A new section added to the Code will benefit those who maintain an elementary or high school student

Gamma ray equipment used to measure sub-surface densities

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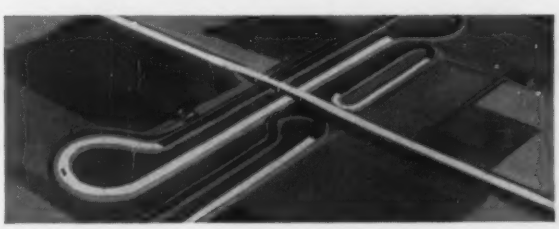
The entire National Road Test project is the most scientific experiment ever carried out on highway pavements. Modern statistical techniques, the newest in instrumentation, recording and automatic data processing equipment assure the total reliability and impartiality of findings.

Vital data have been pouring in, useful new facts on pavement performance are evident. The final result—a storehouse of engineering information needed by every engineer, official and legislator to plan and build the most practical, efficient road system possible.

For Interstate highways—and all roads and streets—the National Road Test will prove the most significant test of pavement types of all time.



836 test sections—repeating nearly 200 different pavement combinations make up the loops. Over 1,100,000 load applications have been recorded.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

(other than a dependent or relative) in their home, under a program sponsored by a charitable organization. This deduction is limited to $50 per month for unreimbursement amounts, and is listed as a contribution to the specific charitable organization.

¶ Estimated Tax — This amendment applies to tax years beginning after 1960. The taxpayer need not make a declaration of estimated tax for 1961 if such estimated liability is less than $40 or if the income not subject to withholding does not exceed $200. The only gross income test now is whether or not there is over $200 of income not subject to withholding.

¶ Moving Expenses — Any person who accepted employment with corporations operating scientific laboratories for the Atomic Energy Commission may exclude from their gross incomes the reimbursements received for moving expenses, to the extent that they were so used. The reimbursement must have been received after 1949 and before October 1, 1955, and the employee must have been informed at the time of his employment by an authorized corporate representative that the reimbursement would be excludable. A refund claim must be filed within six months of September 14, 1960.

¶ Travel and Entertainment — There has not been a change in tax law so much as a change in the approach to this problem by the Treasury Department. An employee should document each and every item of travel or entertainment expense he incurs for his employer, whether he has a flat expense allowance, is reimbursed for such expenditures, or signs credit cards on behalf of his employer. The employee may be called on to substantiate these expenditures, and the more evidence he can provide, the better off he may be. As was pointed out earlier, the 1960 tax returns may require an employer to disclose the amounts his employees have received. ▲▲

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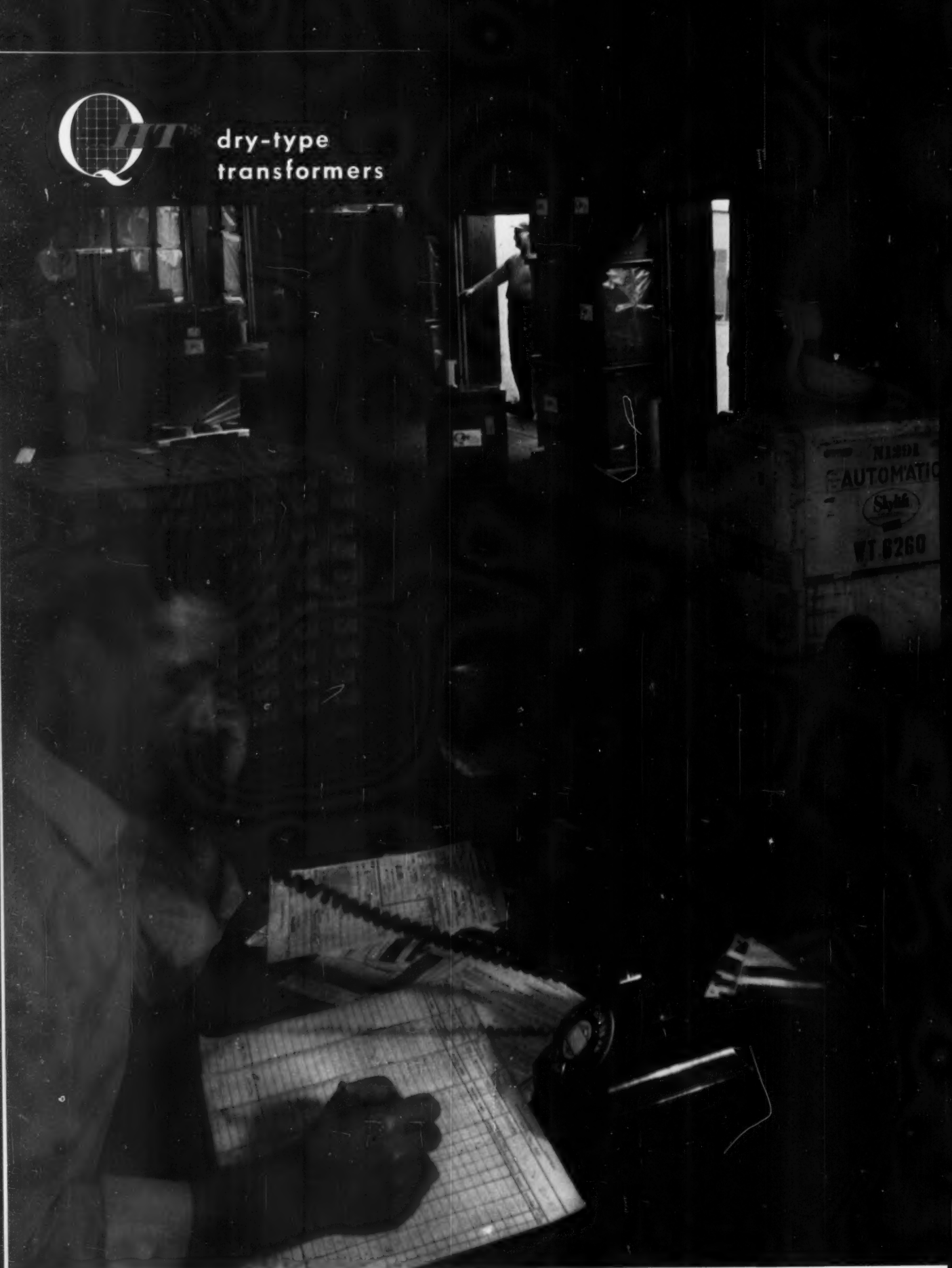
City_____ State_____

Type of business_____

QHT dry-type transformers



Distributor-to-factory direct order service speeds shipment of General Electric QHT dry-type transformers.

You can get 24-hour shipment on most General Electric QHT dry-type transformers

Forget about changing your schedule because you can't get on-time delivery of dry-type transformers. You can get most General Electric QHT dry-types as fast as you need them. Chances are the QHT transformer you want is one of the popular ratings your nearby General Electric distributor keeps in stock. If so, you can get immediate delivery. Otherwise, your G-E distributor can, within minutes, place your order on the General Electric factory, where stocks of 900 models are kept. A direct order arrangement with the factory enables him to do this. Within hours your QHT transformer will be on the way to you by whatever means are necessary to meet your schedule.

QHT transformers also save production space because they offer savings up to 50 percent in weight and 67 percent in size compared with competitive dry-types. You can easily mount QHT units in out-of-the-way places near the load and save the cost of long, low-voltage feeders.

QHT dry-type transformers are quiet, making them ideal for schools, hospitals, office buildings, and other places where noise could be a problem. Each rating of QHT transformers has a sound level equal to or less than NEMA standards. QHT sound levels are at least 15 decibels less than older designs.

Installation is fast and easy. You wire General Electric QHT transformers from the front. Conveniently placed dual-sized knock-outs, large terminal compartments, solderless connectors, and numbered terminals save time.

For more information, call your nearby General Electric distributor. Or write for GEA-6907A "QHT Specifier's and Buyer's Guide" to Section 411-18, General Electric Co., Schenectady 5, N. Y.

* Registered trademark of General Electric Co. for quiet, high-temperature dry-type transformers.

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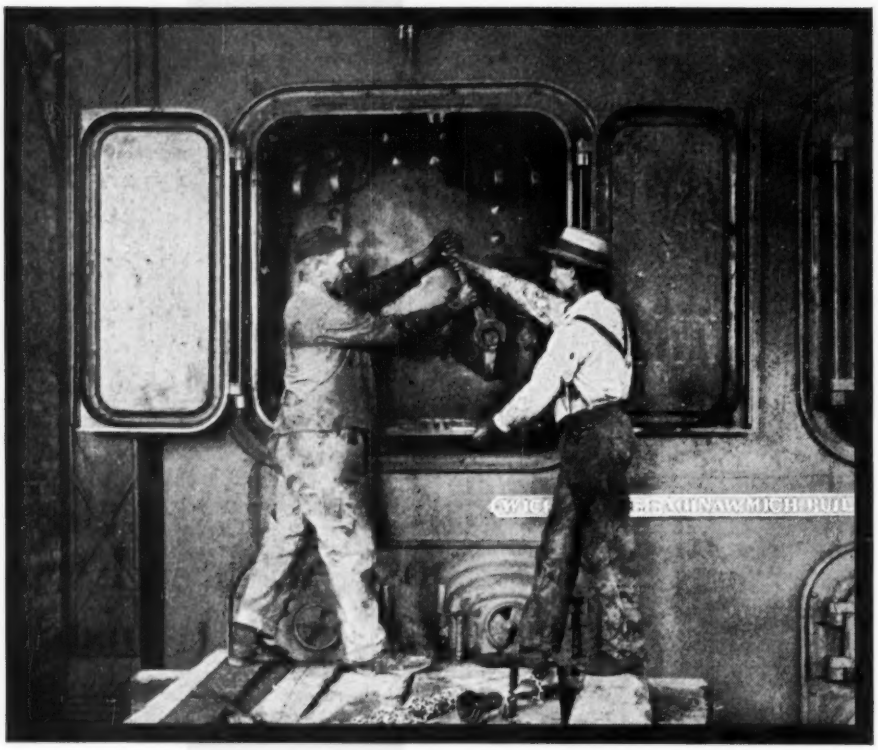
GENERAL ELECTRIC

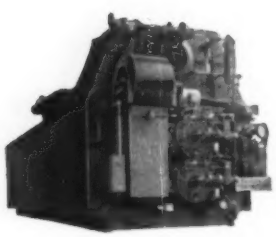


This boiler, built by Wickes Boiler Co. in 1875, operated satisfactorily for the next 31 years.

When buying modern Boiler Equipment it pays to deal with an *EXPERIENCED MANUFACTURER*

There is no substitute for experience. From the first pioneering days in boiler manufacture, years before the boiler pictured above was built, Wickes Boiler Co. has continued to be a world leader in the development of economical, efficient and dependable steam generators. Today, Wickes builds steam generators in sizes to 500,000 lbs. of steam per hour, for high or low steam pressures and temperatures and for all types of fuels and firing methods.

A Wickes steam generator, custom engineered to exact generating requirements, is built to the highest standards of workmanship, backed by over a century of boiler making experience.



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WICKES

175

WICKES BOILER CO. DIVISION OF THE WICKES CORPORATION, SAGINAW 16, MICHIGAN

The Council at Pittsburgh

Mass Meeting on the Monongahela

THE SEMIANNUAL board of directors meeting of Consulting Engineers Council followed so hard upon the national elections that many of the directors found it hard to make the quick switch from politics to private practice. At any gathering of consulting engineers, a Democrat is as rare as the center of an expense account steak, but there was surprisingly little viewing-with-alarm. There seemed to be a semisubconscious recognition that even if they squirmed and tried to wiggle away, consulting engineers would be heartily force-fed by a new administration pledged to plentiful public works. Consulting engineers are going to prosper whether they want to or not.

Getting down to business in the Terrace Room of the Penn-Sheraton, in Pittsburgh, President Smith again found every one of the 31 affiliated associations represented by a director; every officer in position at the head table; Earle Rader, of Florida, as director representing the Members-at-Large; and various assorted national committee chairmen and alternate directors all present. In addition, the Consulting Engineers Council of Washington, D. C., represented by J. Gibson Wilson, was accepted as the 32nd member of the Council.

With so large a group participating, these meetings resemble conventions more and board meetings less at each successive gathering. For about two years now, the unwieldiness of the organization (originally set up as a 10-association federation) has been apparent, and Ross Zumwalt, of Texas, has regularly come up with suggestions for reorganization along regional lines. He believes this would simplify and make more operable a board of directors that soon will find it impossible to shift its own weight if it continues to grow. Whether Zumwalt has the right idea in proposing regional meetings is open to some question, but there is surely no doubt that something needs to be done about a 33-man board of directors, each director backed by an alternate, and the whole capped with a five-man executive committee. A group of this size can indicate its general approval (or disapproval) of actions taken and actions proposed, and it can in that way establish general policy, but it cannot debate, argue, discuss, and deal with some 150 items of agenda in 2½ days. For a group of this size to act wisely and well, it would have to sit as a congress or parliament and meet daily for months.

The natural result of this unwieldiness is a tendency to delve fully (much too fully, in some instances) into every aspect of a few items early on the agenda and then to race with just a bare "by-your-leave" through many equally important topics that find themselves jammed into the last few hours of a Saturady session. This is unavoidable if details are to be picked over by a great group, all of whose members are intensely interested but necessarily without background in much that they must vote upon.

The solution is a reorganization that would make a House of Delegates out of what is now the Board of Directors, meeting, as it does now, once or twice a year but with a much simplified agenda that puts before the group condensed reports of actions taken or planned. This House of Deelgates would approve or disapprove as it saw fit and thereby establish broad policy. In addition there should be a new Board of Directors of perhaps 12, comprising the five-man executive committee plus about seven regional vice presidents. This would be the working Board that might meet four times a year and act upon a full agenda of the type now presented to the annual and semi-annual meetings. The Executive Committee would continue to meet frequently to conduct the actual detailed business of operation.

In effect, a change of this sort would be simply a matter of putting the affairs that deserve detailed discussion back into the lap of a small group, all of whose members could be intimately familiar with all the topics on the agenda, a group of such manageable size that it could meet about a table rather than in an auditorium.

Actually, the exact form of the reorganization is not vital. This suggested arrangement is simply one of several, any of which could be quite satisfactory. What is important is to find a way for the detailed agenda, with its literally hundreds of items, to be taken off the shoulders of a great and growing assembly, that still is termed a Board of Directors, and turned over to a group of sensible size and flexibility. Yet, this should be done without subtracting from the interest in the large group that has established an unmatched record of attendance.

Then, looking in the other direction, it seems that it is now about time for the Council to give some thought to an Annual Convention of all members of all the affiliated associations. There are now about 1600 engineers who are members of these associations — and hence of the Council. This is a large enough group to permit a conven-

tion of respectable size, particularly if it were held at the time of the Annual Delegates Meeting.

Unfortunately, money is still the Council's nagging problem. Its budget is close to $90,000, and that is met by individual dues averaging between $50 and $60 per principal of a participating firm. This seems modest enough (at a lunch table in the hotel, a group discussing dues found that the waitress paid more to her union than the four together paid to CEC), but there is obviously a lot of pressure at the local level in some associations, probably on the part of members who are looking for a $5 luncheon club, for CEC to provide more services for less money. Treasurer Les Bosch has had to do some scraping to provide even the same level of operations as last year, while the individual associations all too often hold out as long as possible before coming through with their assessments.

Metropolitan New York seems particularly provoked over the failure of the Council to move its home offices to Washington. The executive committee takes the position that there is no reason for moving the headquarters simply to change geographical locations. Everyone acknowledges that Washington is the proper place for the Council, but it is the committee's position that a Washington office is required only after the hiring of some sort of executive director qualified to represent the Council as a Colonel among Colonels — some sort of big frog who could croak with position and authority. When such a man is employed, says the executive committee, he obviously must be given an office in Washington, but why worry until that time comes.

New York City sees it differently. To this affiliate, it is a matter of face. It wants a Washington address in the same way an ambitious socialite wants a good address. It seems that NYACE cannot believe that anything good can come out of Springfield, Illinois. And as it so rightly points out, anything good that has come out of Springfield has quickly gone to Washington. As a matter of fact, it is the sincere feeling of the New York City members that there has been too much delay and procrastination. They think that it would cost no more to function from Washington than from Springfield, and they are perhaps justified in feeling that if the Council is waiting for the money to hire top brass, it might just as well wait in Washington as in Springfield.

It is necessary to remember, too, that the reason for the headquarters being in Springfield has long since ceased to exist. Len Crawford was elected secretary way back when the Council had no office, and the headquarters simply went to wherever the elected secretary had his practice. Crawford is from Springfield. But now there is a staff,

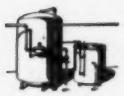
and there are no elected officers located anywhere near Springfield, New York City sees Springfield as an anachronism.

At the moment, NYACE is feeling bitter, while the executive committee is being adamant and continues to plead poverty from Springfield. Perhaps the new Washington, D. C. association can provide a solution by finding good new offices at a low price and in the meantime mollifying New York by offering to handle some of the Washington liaison New York claims is so badly needed.

Should the Council make this move to Washington, it should try to take its current executive secretary along. Larry Spiller may not be a retired general with direct connections to the White House, but he is a most capable and efficient executive who knows more about the day to day workings of the Council than anyone else. He is, without doubt, a great asset in Springfield or Washington.

Toward the end of the second day of the meeting, when the assembly was beginning to doze, Joe Williamson brought them back awake with his report as chairman of the ethics committee. He recommended that there be no more ethics committee and that the Council simply drop ethics from its areas of interest. This is not so revolutionary as it may sound, for Williamson then asked that the void be filled by substituting activity in the realm of Rules of Practice. The group relaxed again, but this is more than simply a matter of semantics. For some time the Council has been taking a step here and making a slight change there to establish the fact that it is not an engineering society of individuals but a business association for firms. As Williamson so properly pointed out, firms do not have ethics, people do. Firms can have rules of practice, but like the soulless corporation, a business organization cannot properly speak of its ethics. It is Williamson's idea that his Council committee should make a study of the canons and codes, and then separate the ethics from the rules of good business practice, leaving matters of individual ethics to those societies that are set up on an individual membership basis, while the Council takes on only questions of business practices. Competitive bidding, for example, is obviously a bad business practice. Integrity and reliability as a witness on the stand, or upholding of the dignity of the profession are personal matters best dealt with by a personal membership society.

The Board agreed with Williamson and passed his recommendations. Some saw this as relatively unimportant, but it is necessary that a group gradually carve a clear profile of itself and understand its purposes. For a young organization, the Council is doing excellently. Every year it gets a better idea of its reason for being, and it is not making the grand



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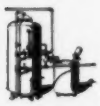
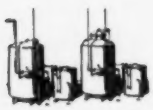
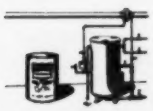


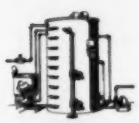
ULTRA-DEIONIZERS — produce highest quality mineral-free water. Replace distillation methods at fraction of distillation cost.



DEALKALIZATION & ION EXCHANGE SYSTEMS—Dealkalizers to control alkalinity. Ion Exchangers to produce water of any desired quality.

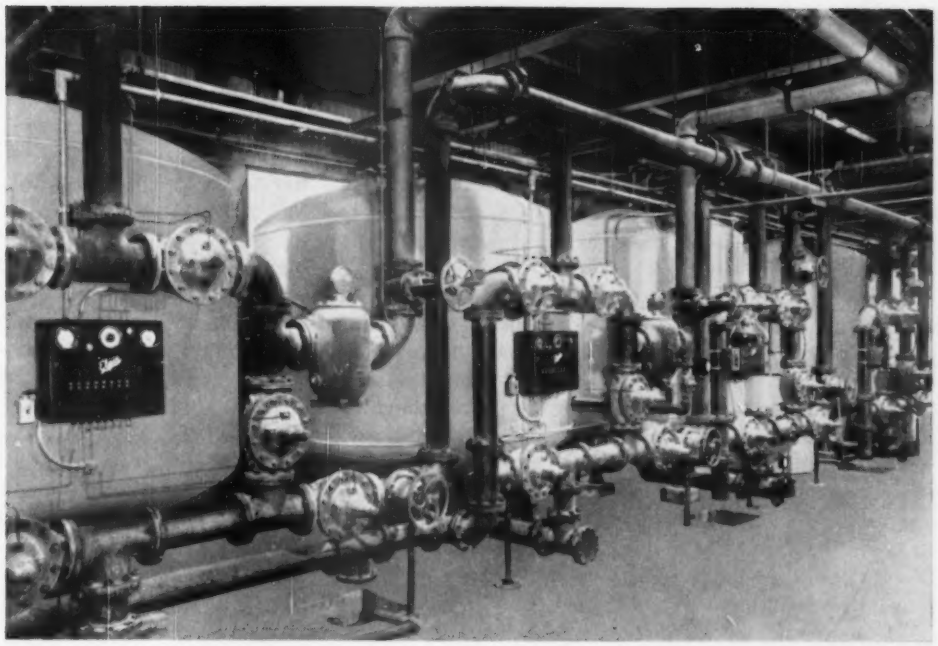


CHEMICAL TREATMENT SYSTEMS—prevent scale, corrosion and depositions with Elgin specially formulated chemicals.



CLARIFIER—for removing excess alkalinity and solids for clarification of turbid waters.

DEGASITORS—for removal of entrained gases from water by aeration.



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WHO IS QUALIFIED

To handle your water conditioning job?

Today's remarkable advances in water conditioning should suggest methods and equipment that can perform a profitable service for you . . . and this brings up the all-important question:

Who is best qualified to get right down to the practical job of putting these advanced methods to work for you under your specific conditions?

Certainly the best answers will be found in an organization like Elgin that knows and offers *every* modern and authoritative approach to *any* water conditioning problem.

The scope of Elgin equipment and services is briefly touched upon here. To cover the full line would require many pages, but whatever your problem, Elgin with 50 years of intensive specialization is well qualified to solve it. No other organization is better equipped to determine your needs and meet them in the best and most economical way.

Your nearest Elgin Representative would like to put our fifty years of experience to work for you. Or, if you prefer, tell us your conditions and we will send covering bulletins.

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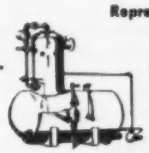


DEAERATING HEATERS—supply make-up water pre-heated by exhaust steam in which CO_2 and oxygen are eliminated.

WATER FILTERS—Diatomite, sand, anthrafilt, activated carbon and oil removal filters in all types and sizes.

mistake of trying to be all things to anyone who will pay dues.

An important matter arose that has to do with ethics — but with the ethics of the client rather than the ethics of the engineer for a change. More and more frequently engineers find they are being asked, in negotiations for projects, whether they carry errors and omissions insurance, and then their policies become a part of the contract. This can lead to serious consequences, for clients apparently are coming to think that the quality of the work, the reliability and ability of the engineer, and the professional approach is so much belly-wash that can be forgotten if there is enough insurance to cover mistakes made by small minded technical jerks. Any self-respecting doctor would kick a very sick patient out of his office if he insisted on knowing how much malpractice insurance the doctor carried before agreeing to an operation. It would be so much as admitting that the prospective patient intended to bring his attorney into the operating room to count the sponges before and after surgery.

This will be a hard one to handle. The Council already has taken a stand on it and has declared improper the use of professional liability coverage as a sales point in negotiating with a prospective client. But that will not keep the client from bringing it up, and there are few consulting engineers who will be brave enough to tell a client just what he can do with his project if he insists on being a sponge counter. The last few years have seen a sharp dip in premiums on professional liability insurance, but the trend may be reversed.

William Moore, of Dames & Moore, reported on the last meeting of the International Federation of Consulting Engineers (FIDIC) which he attended as the representative of the Council. He feels, as do all who have attended FIDIC meetings, that participation in this group is valuable now and will be much more valuable in the future. Moore suggested that the Council should sponsor a trip to the next FIDIC meeting (probably in May, in Luxemborg) so that as many U. S. engineers as possible could observe an international meeting in action. He suggested that this could be followed by a trip to several other European cities for luncheons or dinners with national associations affiliated with FIDIC. He said he had in mind a trip of the type sponsored by CONSULTING ENGINEER magazine in 1956 and 1958.

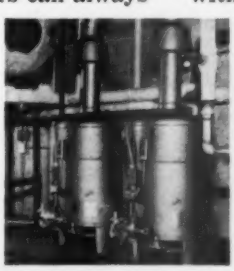
The next meeting of the board of directors of the Council will be in May 1961, in Chicago. This will be followed, in November, by a semiannual meeting in Florida — probably Miami, while the 1962 Annual Meeting already has been scheduled for New Orleans. ▲▲

Five Fred Harvey "over-the-road" restaurants serve motorists on the new Illinois Tollway. Each restaurant is equipped with a fast-recovery, gas-fired Burkay water heating system.

Fred Harvey Tollway restaurants speed service with GAS-fired BURKAY water heaters

Motorists can always be sure of fast service at any of the five Fred Harvey restaurants along the new Illinois Tollway. Restaurant Managers can always be sure of fast service from their gas-fired Burkay water heaters. With the speedy recovery of gas, there's never a delay for hot water.

These Fred Harvey restaurants serve as many as 9,000 meals a day. Dishwashers operate constantly, with many peak periods. Yet there's no waiting for hot water from the fast-recovery Burkay water heaters. And since the units are fired with thrifty gas, fuel costs stay low.



With a gas-fired Burkay water heater you'll always have enough hot water. Hot enough to meet health standards. Fast enough to keep pace with the busiest dishwasher. For complete details, call your local Gas Company, or write to A. O. Smith Corp., Permaglas Division, Kankakee, Ill. *American Gas Association*

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You get double protection against rusty water when you operate with Burkay gas-fired water heaters. Waterways are all-copper. Permaglas storage tank is glass-lined.


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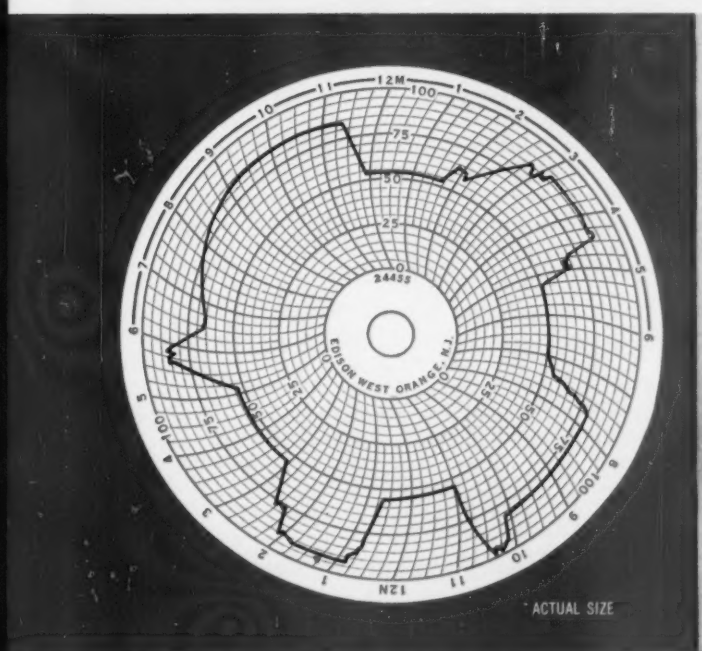
A PRECISE MINIATURE INKLESS RECORDER

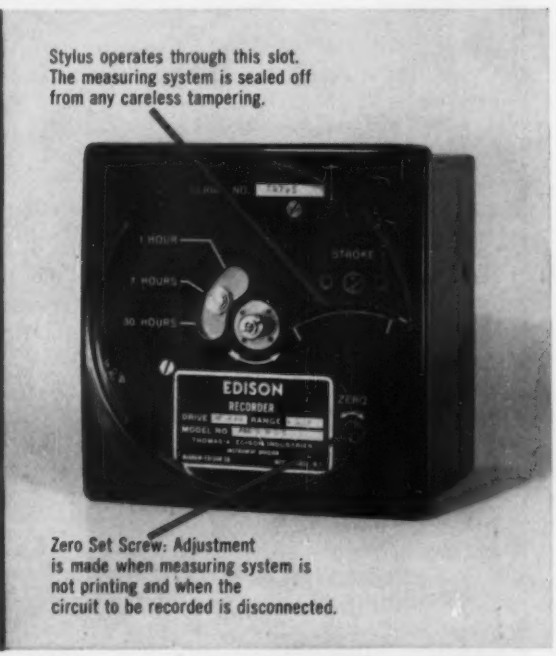
■ INEXPENSIVE ■ REPLACES METERS OR INDICATORS ■ PANEL OR BULKHEAD MOUNTED
■ BUILT-IN VARIABLE CHART SPEED ■ JUST 3¾" X 3¾" X 3" ■ RECORDS ANY VARIABLE

Now you can take advantage of a new, economical means of recording any variable that can be converted to an electrical signal. Thanks to Omnicorder, you need no longer rely on meters or indicators, even where cost factors or space restrictions would ordinarily dictate the use of these instruments.

Measuring just 3¾" x 3¾" x 3", Edison's Omnicorder, a unique circular chart recorder, is so compact that nine units occupy just one square foot of space. Thoroughly legible, yet requiring no ink, pen or ribbon, Omnicorder is equipped with a simple three-speed chart adjustment. It provides a choice of these sequences: one hour, seven hours and thirty hours per revolution—or one day, seven days and thirty days per revolution.

Omnicorder's simple, inexpensive construction assures dependable operation and a long, maintenance-free life. Four types of meter movements are available to measure a wide range of AC and DC electrical quantities, ranging from thermocouple outputs to currents as high as 600 amperes with accessory current transformers. No amplification is ever required, even for signals as low as 10 microamps.





For complete information on this rugged, maintenance-free Omnicorder, write for Catalog 3057.

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87 LAKESIDE AVENUE, WEST ORANGE, N. J.

The New Projects

Indus Canal System

The agreement between India and West Pakistan over the division of the waters of the Indus River basin signaled the beginning of work on one of the world's most extensive irrigation and water conservation projects. A series of seven canals, totaling nearly 400 miles in length, will be dug in the lower river basin; two huge storage dams will be built in the headwaters of the rivers, near the Himalayas.

The canals, each about 100 yards wide, will link the Indus with the five other major streams in the region. Engineering for the canals will be done by the Denver firm of Tipton & Kalmbach, Inc. T & K contracted with Hunting Surveys, Limited, of London, for aerial surveys of the entire region. Hunting has already completed strip photographs of the entire route of each canal, as well as some 250 square miles of block mapping for headworks and barrages.

Hunting also flew aerial surveys for the British firm of Binniem Deacon & Gourlay, engineers for the storage dam at Mangla in northeastern West Pakistan. The dam at Mangla, and another to be built later at Tarbella, will be used primarily for power. The canal system, when it is completed, will be used primarily for irrigation.

Michigan Design Award

Two recent projects by Albert Kahn Associated, Architects and Engineers, won awards from the Detroit Chapter of the American Institute of Architects. An office building for the National Bank of Detroit won honorable mention for design, and a parking structure at the Henry Ford hospital was awarded a prize for excellence of design.

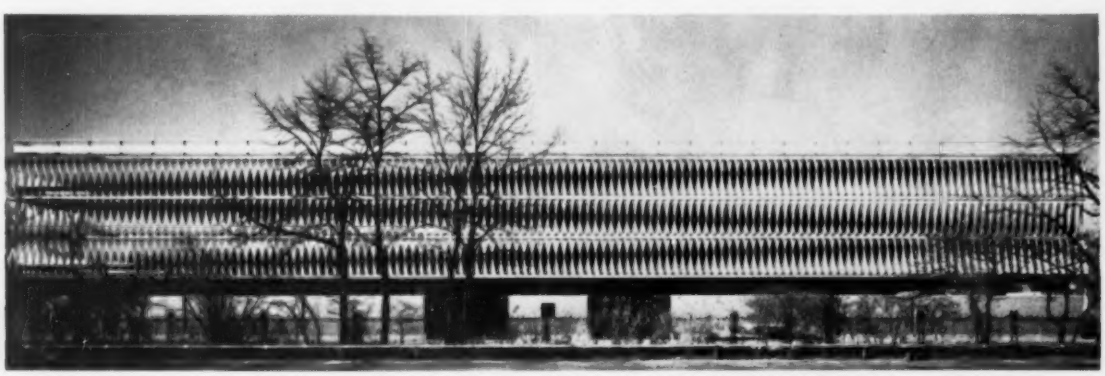
Earlier in 1960, the parking structure was chosen for exhibition at the Institute of Civil Engineers in London. The British group cited the building as a parking structure of world-wide significance.

Air Conditioning a Landmark

The London Guarantee Building, in Chicago, which won the National Award for design when it was built in 1923, was completely air conditioned this year in an attempt to keep it as premium office space. Designed by the Robert Hattis Engineers, Inc., of Chicago, the new system was installed in six months without interrupting the tenants' businesses.

More than 900 Trane fan-coil units were installed, each with outside air intakes. Water for condensing purposes is taken from the Chicago River and returned through tunnels under Wacker Drive. Most of the cutting and piping was done at night to avoid interference with normal occupancy.

The building, on one of the most advantageous locations in the city, contains about 200,000 square feet of rental space. Through use of the Trane units,



The new parking structure at Henry Ford Hospital in Detroit, winner of national and international design awards.

and piping installed in an unused elevator shaft, the entire installation was completed without loss of any valuable office space.

Nigerian Port Modernization

As a part of the recent independence celebration in Nigeria, a $12 million wharf extension at Port Harcourt was formally inaugurated. The port expansion program, planned by the London consulting firm of Coote and Partners, included nearly a half mile of wharf wall; three large transit sheds; a warehouse; and dock offices including Customs House, workshops, and storage area. In addition to greater harbor facilities, the country will benefit directly from the number of native personnel who were trained in the building trades as part of the project.

New Capital Hospital

The engineering design for the new $6 million Southeast Hospital in Washington has been awarded to Guy Panero Engineers, of New York. The new hospital, occupying over 20 acres of land, will have 300 beds. Ground is expected to be broken sometime this year, depending on the availability of funds. The Federal government is expected to pay half the cost of the hospital.

Potomac Filtration Plant

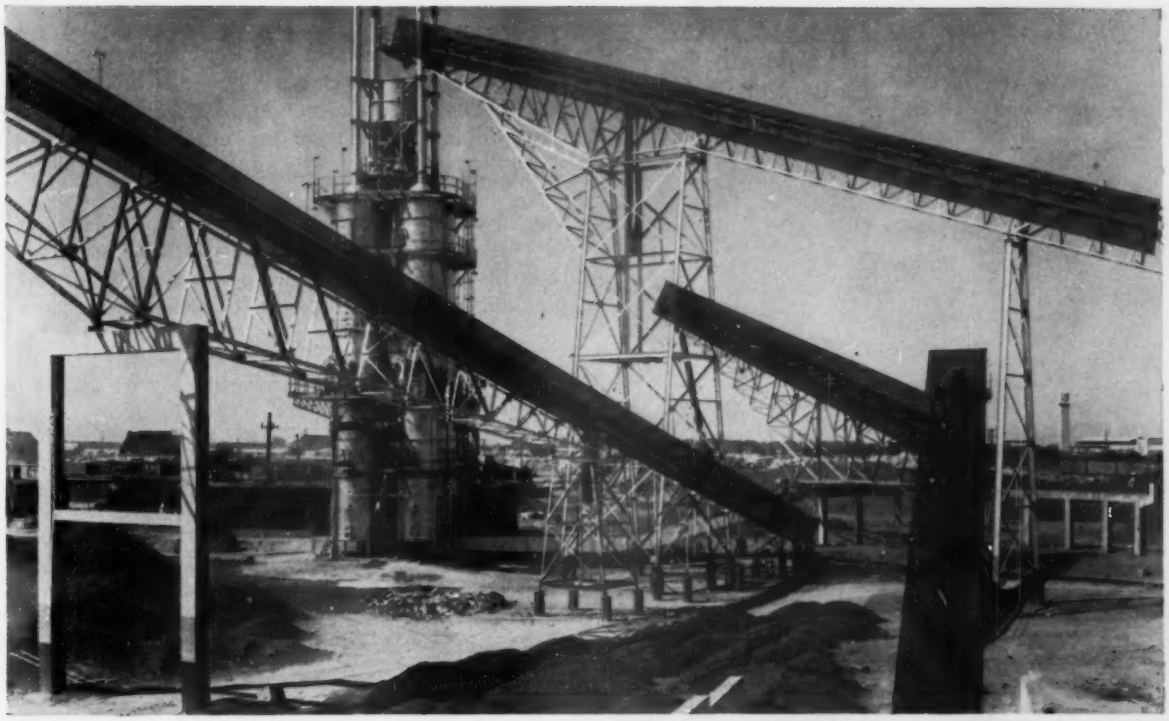
Officials of the Washington suburban Sanitary Commission recently laid the cornerstone for a new water filtration plant at Rockville, Maryland, on the Potomac River. The new plant, with a daily capacity of 30 million gallons, will supply Montgomery County and nearby sections of Maryland. Consulting engineer for the project is the firm of William Requardt & Associates, of Baltimore.

New State's New Capitol

The state legislature of Hawaii selected the Honolulu architect-engineer firm of Belt, Lemmon & Lo to design the new state Capitol building in Honolulu. B L & L is a partnership of five firms: Lemmon, Freeth, Haines & Jones, architects; Belt, Collins and Associates, civil engineers; Donald T. Lo, structural engineer; Wynn M. Nakamura, electrical engineer; and Montgomery and Kohloss, mechanical engineers. Preliminary design and estimates are to be ready for the legislature early this year.

Pakistan Water Development

The government of east Pakistan has commissioned the Harrisburg, Pennsylvania, consulting engineer firm of Berger Associates, Inc., to set up a water de-



Rotating stacker belt

PLANET SYSTEM CONVEYS, SORTS AND STORES 150 TONS OF IRON ORE PER HOUR . . .

another example of Planet Versatility . . .

Near Monterrey, Mexico, stands the maze of conveyors partially shown above. This system's job is to convey 150 tons of iron ore per hour through crushing operations to segregated storage areas, then reclaim it by grade. And it is one of many examples of PV—*Planet Versatility* . . . Planet Corporation's ability to find efficient solutions to production, materials handling or automation problems, big or small.

From a pit where the ore is crushed, a 24-inch trough-belt conveyor carries it to a secondary crusher. Here the rock is reduced and screened. Chunks larger than 1-inch diameter are recirculated, the fines are separated and transferred to a special stacker, and the usable ore is conveyed to a rotating stacker belt which piles it according to grade. To reclaim the ore, Planet constructed a series of tunnels under the storage area. The tunnels allow selection of the grade of ore to be conveyed to the retort in which sponge iron is made.

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velopment program for a 5000 square mile tract in the Kalni River basin. The region, which is only about 10 feet above sea level, receives an annual rainfall of 200 to 400 inches. The Berger group is to plan conservation and drainage for the area.

A Roof-First Coliseum

The recently completed $8 million Memorial Coliseum in Portland, Oregon, is particularly impressive because its walls are constructed entirely of glass and plywood. Four 70-ft concrete corner columns were

Portland's Coliseum, an extreme in non-bearing walls.

erected, and the entire roof was constructed on them before work was even begun on the walls. This permitted completion of the walls and interior work during the winter months.

The walls are a combination of gray tinted glass and a special white surfaced plywood. The 22-ft white fascia around the top of the building is an acrylic surfaced exterior plywood, supplied by Georgia-Pacific and U. S. Plywood. Over a quarter-mile of the new product was used in the Coliseum. Engineer was Moffatt, Nichol & Taylor, of Portland.

Executive Airport

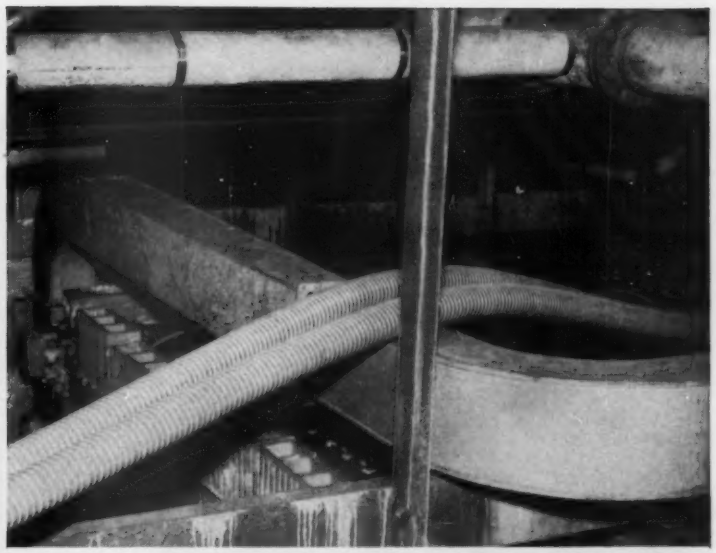
Preliminary work has begun on a new $8 million airport between Fort Worth and Dallas, on U. S. 81. The airport will be for business and private flying only, and will accommodate planes as large as the DC-7. Designed by Harkrider, Clark and Jones, of Fort Worth, the executive field will include 24 hour tower control, a motel and restaurant, and convention facilities.

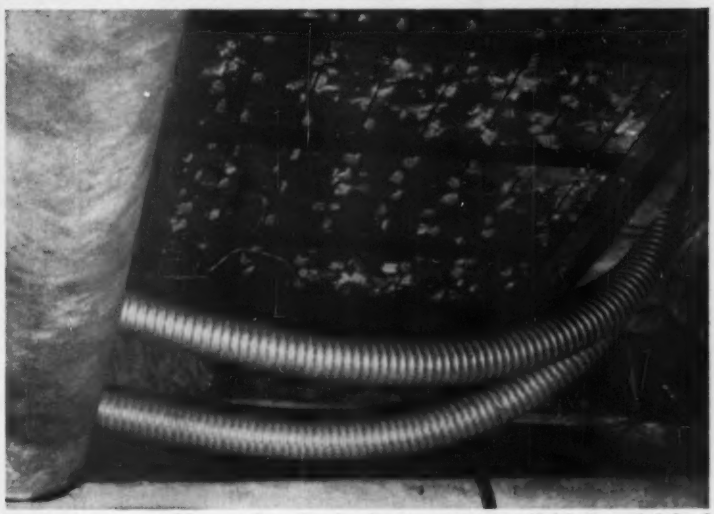
South of the Border

Refineria Shell de El Salvador has awarded Fluor-Schuytvlot N. V., of Holland, a contract for the engineering and construction of El Salvador's first oil refinery. The refinery, capable of handling 10,000 barrels of crude oil a day, will be built near the city of Acajutla, El Salvador.

Stack Going Up

Expansion and modernization plans at the Oxford Paper Company, in Rumford, Maine, called for a new 300 ton capacity recovery boiler unit, requiring





For air conditioning: Three conductor, 500 Mcm, 37 wire, 25/64" varnished-cambric insulated Anaconda Duralox Cable was quickly, easily installed in older building to handle new load. Cable runs from breaker box in west wing (left) through loft of roof (top right) to side wall building and down wall (bottom right) to breaker box on lower floors.

PROBLEM: Installing new circuits in old building
SOLUTION: Duralox Interlocked-armor Cable

or: *How to do a hard job the easy (and low-cost) way*

Installing new circuits in an old building—whether for air conditioning, as the case here, or for new machinery or new load centers—can be tough and costly. You either have to go around existing obstructions, a laborious job with rigid conduit, or remove them.

The ideal solution is Anaconda Duralox Interlocked-armor Cable.

Because it is flexible, Duralox Cable is quick, economical to install—indoors or out—with simple supporting devices. It trains easily around corners, columns and other obstructions in *long, unbroken runs*. Circuits are easy to relocate . . . always accessible. Duralox's interlocked metal-tape armor affords excellent protection against mechanical damage.

Anaconda Interlocked-armor Cable is available in sizes No. 6 Awg to 750 Mcm—copper or aluminum conductors—up to 15 Kv. Underwriters' approved for 600 volts and 5000 volts. With rubber, plastic, or varnished-cambric insulation.

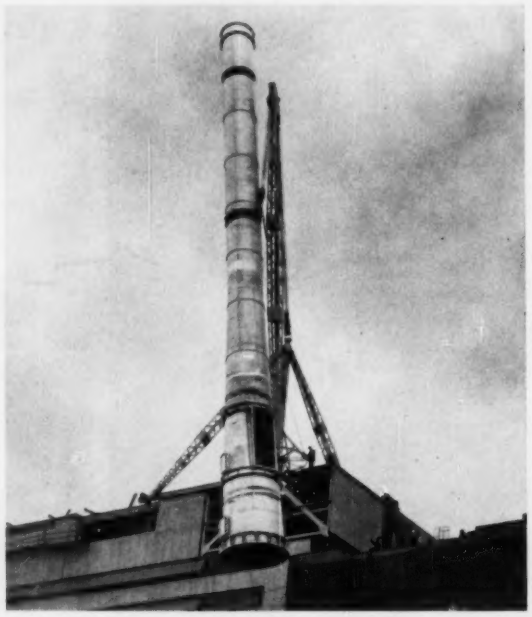
BULLETIN DM 5606 on Anaconda Duralox Cable gives you full information. Write for your copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

ASK THE MAN FROM **ANACONDA®**

FOR **INTERLOCKED-ARMOR CABLE**

a 125-ft stack. The Rust Engineering Company of Pittsburgh erected the new stack, already assembled, in less than an hour.

The 28-ton stainless steel stack was originally designed to be put up with the building. But a crippling



125 ft, 28 ton metal stack hoisted into place in Maine.

strike halted work on the steel sections, and the engineers decided to go ahead with the building.

When the stack was completed, a 30-ton stiff leg derrick was mounted on the roof framing of the new building. A ¾-in. line was wrapped below the slip lugs on the stack, and 47 minutes later it was in place. The entire operation was carried out by the construction division of The Rust Engineering Company, of Pittsburgh.

Parking Deck Bridge

The city of Sioux Falls, South Dakota, is building a two-level concrete parking ramp across the Big Sioux River. Major span of the deck is 55 feet, with a cross section depth of 34 inches. The half million dollar project will provide parking space for nearly 300 cars, and will connect other distant parking areas with major destination areas. Structural and electrical engineering is being done by the firm known as Ramp Engineering, of New York.

Park-In Bank

The Commercial National Bank of Peoria, Illinois, is building a six-level parking ramp adjacent to its main office in the center of Peoria. The new building will house four drive-up teller windows and will provide

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***joist-ol'o-gy, n.** (As Webster *should have* defined it) The art or science of designing and building more economical structures through the use of open web steel joists.

Architects, engineers and school officials throughout the country have found that all types of school buildings—single or multi-story—can be constructed more efficiently and economically through the use of steel joist floors and roofs.

Steel joists have been used in more school buildings than any other type of construction, because of low material cost and equally economical placing and handling costs experienced with these all-purpose structural members—light in weight but long in span and adaptability.

The continued specification of steel joists in school buildings will help make possible the completion of many critically needed school structures within the budget of the community.

The Steel Joist Institute has published several helpful technical manuals on the construction, performance and application of open web steel joists, including specifications and load tables, an open web steel joist catalog, and new data sheets. The Institute will be happy to send you any or all of this material, on request, at no charge.

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Steel

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some parking space for customers going into the main office, but most of the new structure will be used for transient or monthly rate parking of nearly 400 cars.

There will be virtually no level areas in the ramp, because of an ascending parking ramp and a descending exit ramp, pitched to both sides for drainage. The structural engineers, Enco Engineering, of Detroit, used reinforced concrete throughout the 180 ft square building.

Anchorage Plans Ahead

The city of Anchorage, Alaska, has selected the Millbrae, California, engineering firm of Wilsey, Ham & Blair to prepare a 20-year plan to guide the city's growth. Under the contract, W H & B will provide a general plan for expansion of the city and adjacent metropolitan areas through 1980, and will provide specific plans for a civic center, a central business district, and all public utilities.

Lead Seals and Lubricates Niagara Conduits

The Western hemisphere's largest hydroelectric development, the $720 million Niagara Power Project, is using sheet lead as a gasket at the base of two 66 ft conduits, each more than four miles long. The lead is expected to act both as a lubricant and a seal, preventing seepage of the water which passes through the conduits at the rate of 83,000 cu ft per second.

The concrete base, and the joints formed by the wall section, are sealed with 1/16 in. sheet lead, coated with asphalt to prevent reaction with the free lime in the fresh cement. The lead, in 2-ft widths, is cut into strips about 10 feet long. The strips each

Worker cuts strip of sheet lead for Niagara project.

weigh about 80 pounds; bigger strips than these are too heavy for convenient handling on the job. In all, a total of 88,000 lineal feet of lead will be used, amounting to about 352 tons. Consulting engineer for the project is Uhl, Hall & Rich, of Boston. ▲▲

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Speedline® FITTINGS ARE MADE TO MEET CRITICAL STANDARDS

Now you can comply with the severest codes and save up to 50% on *critical* stainless steel process lines when you specify SPEEDLINE Fittings and economical light wall Schedule 5 or 10 pipe.

The new issue of Code for Pressure Piping ASA B31.3-1959, for example, allows a *design pressure* of 611 psi for 2″ ips Schedule 5, Type 304L process pipe at 100°F. Under the same conditions, allowable design pressure for 1½″ ips pipe would be 768 psi; for 1″ ips, 1122 psi.

Since SPEEDLINE Fittings have been specially designed for use with light wall pipe, they can result in substantial installation economies whether you plan to butt-weld, flange or socket-join your lines. Yet *long tangent* SPEEDLINE Fittings cost no more than other fittings which are suitable for "non-critical" service only.

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For Distributor Listings see pages 1513 to 1516 Chemical Engineering Catalog.

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Electrical Protection goes MODERN *with* BUSS Fuses . . .

in the New Service Center of the Public Service Co., of Colorado

This recently completed service center, — located at 2701 West 7th Ave., in Denver, Colorado — has fuses installed throughout the entire electrical system.

The primary voltage at the underground transformer vault is 13,800 volts, 3 phase, 4 wire. Secondary voltage is 120 and 208 — 3 phase, 4 wire.

Installed in the main service entrance are BUSS Hi-Cap fuses; the sub-feeders are equipped with FUSETRON dual-element fuses and the lighting panels are protected by BUSS Fustat fuses.

Modern electrical protection calls for fuses because — fuses cannot be equalled by any other type of protective device for their combined high interrupting capacity, lifetime dependability and maintenance-free features.

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Fusetron dual-element fuses meet todays' demand for safety. They have an interrupting rating of 100,000 ampere rms symmetrical — and for protection of mains or circuits above 600 amperes, BUSS Hi-Cap fuses are designed to safely interrupt 200,000 ampere rms symmetrical.

And fuses remain safe and accurate through the years. They require no expensive maintenance or recalibration — they are always ready to function the instant trouble occurs.

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MARJORIE ODEN
Eastern Editor

Building Research Institute Holds Fall Conference

Field Notes

WORD GETS AROUND fast, and consulting engineers were almost as scare in the audience of the Building Research Institute's recent Fall Conference as they were on the program. To be exact, six consultants were listed on the advance registration list of approximately 600 persons. And no wonder. The program committee, which included 10 manufacturers and three architects, completely overlooked the existence of engineers in private practice. The sessions on preassembled components, for example, included discussions "as seen by" the architect, home builder, general contractor, specialty contractor, building owner and operator, labor, and buliding code official. But there was no discussion of anything "as seen by" the consultant.

A BRI official admitted the complete omission of consulting engineers on the program had been called to his attention, but did not indicate any immediate plans to do anything about it. He said he would look into it later.

CONSULTING ENGINEER did located one consultant who, not wishing to be named as an official barometer, thought the meeting was worth his trip. Another consultant did not want to speak off the record, and went home to write a formal statement on his opinion of the conference.

Rising Costs

Although most of the papers presented at the conference did not relate too closely to consulting, our "barometer" thought the most interesting talk at the conference was presented by Robert Short, of Proctor & Gamble, on the subject "The Building Owner's and Operators' Viewpoint on Preassembled Components."

Short said manufacturers who work hard to make a profit, and then put much of this profit into new and expanded facilities, have difficulty understanding why building costs go consistently in one direction — up. "We are asked occasionally to explain:

"1. Why — in 70 years — the cost of a building has increased more than six times while the cost of a bar of Ivory soap has less than doubled.

"2. Why a contractor can buy a 300 amp electric welder for less today than he paid 25 years ago, while his cost to put up a building has increased 3½ percent.

"3. Why — on the big score board of national cost indices — the cost of construction makes the worst showing of all."

Short thinks the construction industry should attack its problems

of rising costs in the same manner manufacturers do: more research for long range savings, and a detailed study of methods to achieve day-by-day savings.

Preassembly

The architect who gave his idea on preassembly was Carl Koch, of Cambridge, Massachusetts. Koch said many modern architects object to the restraints placed on them by prefabrication and standardization. But he mentioned that some of the most beautiful buildings in history were designed by architects who had little choice of building materials. They had to use stone, and they used it well.

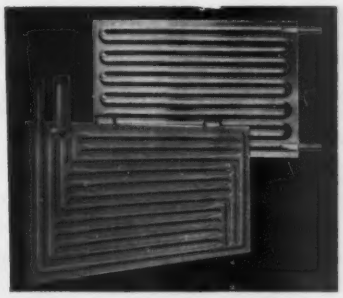
He concluded, "I believe prefabrication components, plus daring and imagination, can help very significantly to achieve a better living environment . . . at a price everyone in America can afford."

Structural Foams

Most of the papers on structural foams were discussions by manufacturers of their own products, so most of the products came highly recommended. Our consultant did not find this objectionable. "I consider myself qualified to judge the merits of a sales talk."

One of the best papers was prepared by Dr. J. Bjorksten, of Bjorksten Research Laboratories in Madison, Wisconsin, whose firm has been doing research on foamed metals. Presented by L. F. Yntema in Dr. Bjorksten's absence, it began by explaining what metal foam is. It is made by "heating under pressure a base metal with a second gas-forming material to a temperature above the melting point of the base metal. The pressure is then released, causing the gas-forming material to decompose. The base metal solidifies into a foamed substance." Most work to date has been on aluminum and its alloys.

Because the porous structure limits conductance of heat into the mass of metal, foamed aluminum is remarkably flameproof, and



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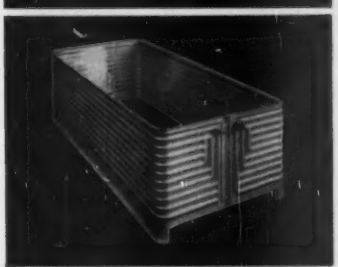

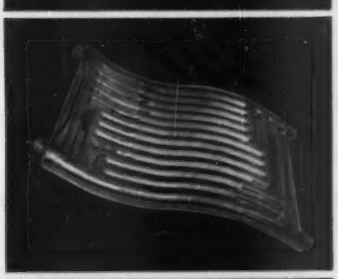

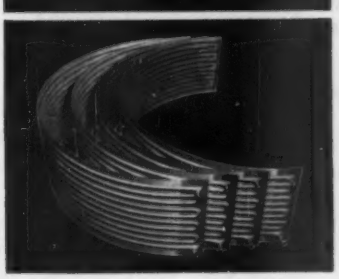

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PLATECOIL provides a "packaged" answer to many heat transfer problems, avoiding costly engineering and fabricating of pipe coils. Units are easy to install and maintain—with simple connections, light weight, and streamlined surfaces. High heat transfer capacity permits compact, space-saving units.

Both "standard" and specially built PLATECOIL are available in mild steel, stainless steel, Inconel, Monel, Ni-O-nel, Hastelloy B, C and F, Nickel and other weldable materials. Operating pressures up to 250 psig. Safety factor—5 to 1. Double embossed or one side flat. Complete engineering data and assistance available.

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Tranter Manufacturing, Inc.

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its nonsparking characteristics also may be a basis for specialized applications in the future.

E. E. Ziegler, of Dow Chemical Company, told of an unusual use for foamed material — application of polystyrene to thin shell construction. As he explained it, "The on-site casting of concrete roofs over wood forms often requires later addition of insulation, a vapor barrier, and a base for interior surface finishing. Polystyrene foam boards bent over and fastened temporarily to irregularly-shaped formwork prior to casting serves all three functions simultaneously. Once the concrete is set and the forms are removed, the exposed foam surface serves as insulation and vapor barrier on the warm side of the roof.

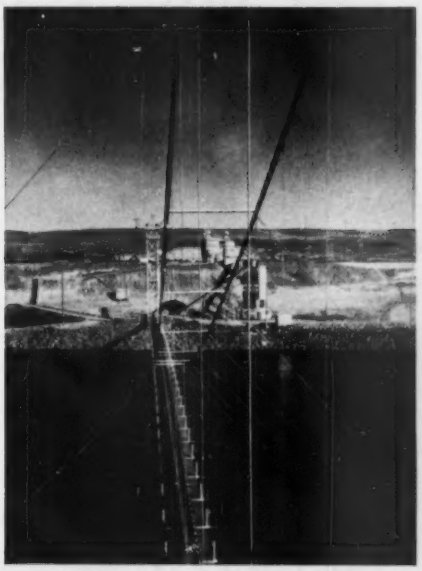
For "tilt up" or "lift slab" construction, large flat or contoured sections can be cast over the foamed material and then tilted or lifted into position, with the foam remaining on the underside.

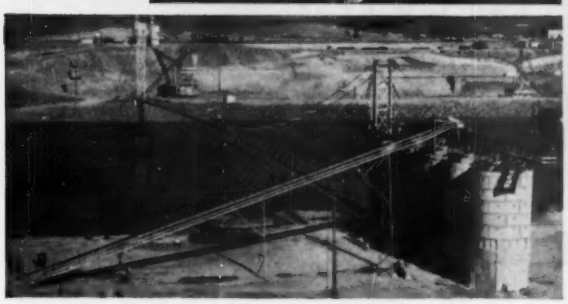
Ziegler added, "For many shell configurations, polystyrene foam can be used as a form. In the construction of a scalloped dome, for example, boards of polystyrene foam have been arched and placed between steel angles, covered with wire mesh, and sprayed with concrete. The arched boards had adequate strength to support the weight of wet concrete during its curing cycle. A full scale test section of a 100-foot diameter dome has been erected successfully by this method."

. . . Loves Company

One of the few consultants at the meeting was asked if, lacking the company of other engineers, he had socialized with clients. "No, but these manufacturers think like clients. And you can always learn something from talking with them. I also enjoy listening to material that is aimed at architects. I think a good engineer should know as much about architecture as does his architect." ▲▲

HOW TO SAVE TIME, MONEY AND MILES WHEN YOU BUILD A DAM





use a Roebling Conveyor Suspension Bridge

The sole purpose of this 1000-foot span, Roebling designed suspension system is to support an aggregate-carrying conveyor. The site is the Ice Harbor Lock and Dam Project at Pasco, Washington, under construction by Guy F. Atkinson Company.

The problem, and it was a large one, was to get the concrete aggregate from the South side of the river to the North side, without having to truck it some 10 miles around. The tremendous amount of concrete needed for the pouring of the dam's locks fully justified the erection of this structure. The savings in time and labor, and the assurance of an uninterrupted flow of material are additional factors that add to its value.

Of course, you don't have to build a dam before a Roebling conveyor *suspension* system can be of value to you. Your needs may be considerably more modest. You may have an in-plant (or "in-and out-plant") materials handling problem. It may be temporary or permanent.

No matter. Roebling designed and constructed suspension systems of all kinds are easing transportation problems for manufacturers and processors with speed, safety and savings. Don't think for a minute that your problem must be of the above magnitude. On the other hand, your needs may be greater. Either way—to carry your conveyor across the yard, or river, or between mountains—a Roebling suspension system can be the most economical answer. For details about your requirements, just ask Roebling's Bridge Division, Trenton 2, New Jersey.

ROEBLING

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Men and Firms

The Consulting Engineers Association of Colorado has named John E. Tracy, partner in Tracy-Behrent Engineering Company, Denver, president. Eugene B. Waggoner is president-elect and William A. Clevenger is vice president. Both are partners in the Denver office of Woodward-Clyde-Sherard & Associates, consulting engineers and geologists. Jan A. Norris, of Carrillo-Norris, civil and structural consulting engineers, is secretary-treasurer. E. Vernon Konkel, of Ketchum, Konkel & Hastings, structural engineers, was named national director for the group.

Coincident with the adoption of a new company name, Bruch and Morrown, Inc., consulting engineers, Minneapolis, announce the addition of three new associates, Donald C. Campbell, John M. Quealy, and Frank Johnson, to their staff. These appointments, in addition to Raymond A. Diekman, now increase the number of associates to four.

Milton S. Sachs has joined the staff of H. Zinder & Associates, consulting engineers, San Francisco. Prior to joining the Zinder organization, Sachs retired after 30 years of government service, his most recent post being that of chief hydrologist with the Bonneville Power Administration. Since last year Sachs has been on loan from Bonneville to the United Nations Special Fund as a consultant on the Awash River development in Ethiopia.

Gustave A. Heckscher has been named assistant vice president in the New Business Department of United Engineers & Constructors Inc., Philadelphia. Formerly new business representative, Heckscher has been with the firm for 13 years.

HECKSCHER

MAXWELL

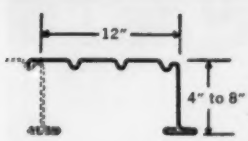
George E. Maxwell has been appointed a consultant on marinas by Frederic R. Harris, Inc., New York consulting engineering firm. Maxwell will specialize in marina consultation in the metropolitan New York area and throughout the nation. Prominent for more than 30 years in the small craft industry, Maxwell heads his own market research, sales promotion, and management consultant organization.

Announcement has been made of the following recent appointments by Engineers Incorporated, of Newark, New Jersey: Anthony Mauriello, formerly engineering administrator, has been named vice president of engineering administration; Walter P. Green, formerly vice president and chief engineer, has been named vice president of administration; and Robert P. Lockitt and Edward G. Stampfi have been named project engineers.

Four new technical staff assignments have been announced by Daniel, Mann, Johnson, and Mendenhall, Los Angeles architects and engineers. Shu Magota has been advanced from acting director to director of engineering and is responsible for the over-all activities of the DMJM departments of engineering; David R. Miller, DMJM project manager for the firm's mass rapid transit study undertaken for the Los Angeles Metropolitan Transit Authority, has acquired additional duties as chief engineer for International Operations Division; Philip M. Linscott has been appointed chief transportation engineer assigned to all aspects of the firm's traffic and transportation work; and James Reiter, formerly a project engineer in the civil engineering section, has been promoted to chief civil engineer.

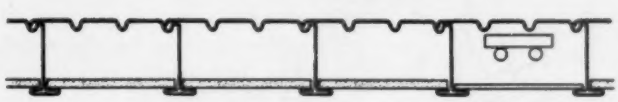
Of the 12 life membership certificates awarded at the annual meeting of the Illinois Section, American Society of Civil Engineers, last

New roof systems for schools...by INLAND

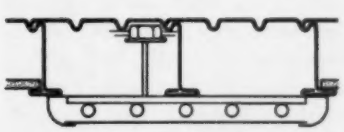


T-STEEL — New! Galvanized. For clear spans to 32'0". Adaptable to acoustical and flush, luminous ceiling treatments. Provides superior diaphragm to transmit seismic and wind loads.

Ceiling Treatments with T-Steel Deck

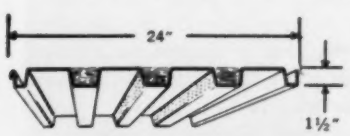


Standard Tile or Board — Light Diffuser

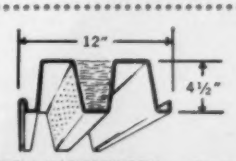


Surface-Mounted Fixture

Lath-and-Plaster Fireproofing



TYPE B ACOUSTIDECK — For purlin spacings from 6' to 10'. Uses minimum of 1" rigid insulation board.



TYPE C ACOUSTIDECK — For purlin spacings from 10' to 20'. Uses minimum of 1½" rigid insulation board.

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1. Acoustideck for gymnasiums, other activity areas

Combines steel roof deck and acoustical ceiling with Noise Reduction Coefficient of .70.

Erected fast in any weather that a man can work. Interesting ribbed underside provides an attractive ceiling.

2. New Inland T-Steel Roof Deck for clear-ceiling classrooms

Especially suitable over classrooms of 26' to 32' spans —or other areas where you want an attractive unbroken ceiling surface.

You can use various types of acoustical tile — provide a flush, luminous ceiling — or leave the underside exposed and painted.

Write for catalogs 240, 241, and 246 or see Sweet's, sections 2c/Inl and 11a/In. Inland Steel Products Company has trained sales engineers capable of giving you the benefit of their diversified experience on specific problems. Write or call your nearest Inland office.

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month in Chicago, three were awarded to consulting engineers — Leonard Chapin Childs, president, Battey & Childs; George Otto Consoer, partner, Consoer, Townsend & Associates; and Herbert S. Grassman, consulting engineer.

David M. Olive has been named coordinating engineer of Bernard Johnson & Associates, consulting engineers of Houston, Texas. Formerly senior engineer in the mechanical department, Olive, in his new position, is responsible for the coordination between the mechanical and electrical engineering phases of all projects.

It also has been announced that Felix W. Stone, Jr. has joined the firm as project engineer. Prior to joining Bernard Johnson & Associates, Stone had his own consulting engineering practice in Baton Rouge, Louisiana.

OLIVE

LANDIS

James N. Landis has been elected president of Engineers Joint Council. Landis, vice president of Bechtel Corporation, San Francisco, succeeds Augustus B. Kinzel who headed EJC for the past year. George E. Holbrook, vice president of E. I. du Pont de Nemours & Company, was reelected as vice president.

Sverdrup & Parcel, consulting engineers of St. Louis, announce the opening of offices in New York City for the general practice of consulting engineering with specialization in the field of tunnel design. Address is Room 603, 111 8th Avenue, New York 11.

Paul Rogers and Associates, of Chicago, is opening a consulting engineering office in Paris, France, in partnership with Mr. Eugene Bonnet. The main purpose of the new firm will be to offer specialized service to American industrial firms entering the European market.

George K. Heebner, Inc., Philadelphia industrial engineers, designers, and builders, announce the appointment of Nicholas P. Roth as the firm's new engineering manager. Before joining the Heebner organization, Roth was executive vice president of the Wallace Engineering and Construction Company, of Philadelphia.

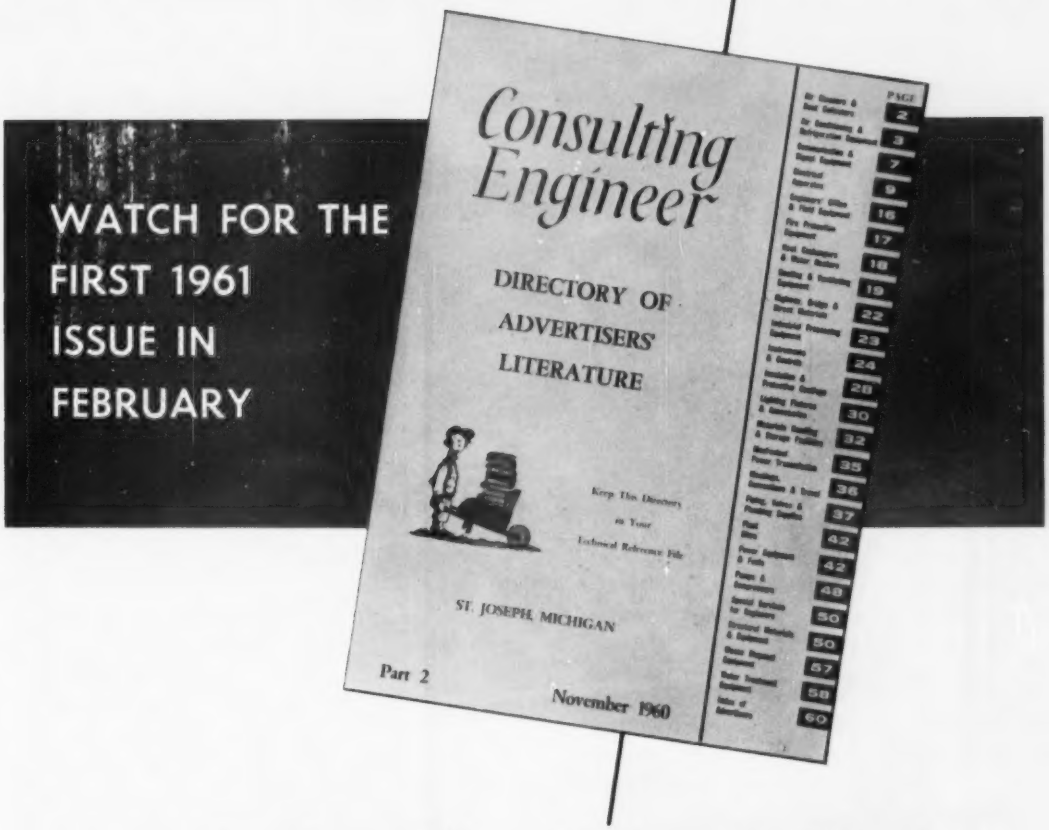
A new partnership, Stitzel & Thoma, has been formed for the practice of architecture and civil engineering. Principals are Richard E. Stitzel, AIA, formerly of Stitzel & Stitzel and Charles W. Thoma, PE, formerly of Scott Engineering Company. Address of the new firm is Suite 412, AC Office Building, Arkansas City, Kansas.

Lawrence J. McDevitt, a marketing and sales specialist for major steel companies for the past 15 years, has joined the staff of Ford, Bacon & Davis, Inc., New York consulting engineering firm. McDevitt will be a supervising engineer specializing in sales and marketing analysis.

Harry Czyzewski, president of Metallurgical Engineers, Inc., Portland, Oregon, has been appointed by the Oregon State Board of Health to its Radiation Advisory Committee. The committee also includes representatives from medicine, dentistry, and education.

Victor M. Garcia has announced the reestablishment of his consulting engineering office and the appointment of Milton Castro as associate in charge of electrical engineering. Address of the firm is 1357 Ponce de Leon Avenue, Santurce, Puerto Rico. ▲▲

Important Product Data*



In Consulting Engineer's Directory Of Advertisers' Literature

Readers of CONSULTING ENGINEER look forward to the quarterly issue of our Directory of Advertisers' Literature. They know from experience how easy it is to review a broad cross-section of manufacturers' current product literature – select the items that will be helpful in their design and specification work – check them off on the convenient selection card – and mail postage paid for prompt service. . . . The first Directory of 1961 will be published concurrently with the February issue of CONSULTING ENGINEER. It will list approximately 650 separate items of product data . . . . illustrated and described for your convenience. Watch for your copy.

Consulting Engineer

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From Armstrong: a giant step in fire-retardant ceilings

Now, for new schools: two types of Acoustical Fire Guard–12″ x 12″ tiles and exclusive new lay-in units

In the school corridor on the left you see the new Armstrong Acoustical Fire Guard *lay-in* ceiling system. The classroom has a ceiling of Acoustical Fire Guard *tile*.

This was the first time-design-rated acoustical tile. Since its development two years ago, millions of feet have been installed.

The new lay-in system is another great advance in fire-retardant ceilings.

Three-hour U.L. rating

The Armstrong Acoustical Fire Guard lay-in ceiling system combines the advantages of an exposed grid system—economy and fast installation—with those of a time-design-rated acoustical ceiling. It protects the structural components of a building by resisting the dangerous transmission of heat from one area to another. Underwriters' Laboratories, Inc., has given this new ceiling system a beam protection rating of three hours. Floor-ceiling assemblies combining this system with bar joist and slab, as well as with beam and steel floor construction, earned two-hour ratings.

Resists 2,000-degree heat

The Acoustical Fire Guard lay-in ceiling system achieves its remarkable fire-retardant quality through two new developments.

The first is the Acoustical Fire Guard lay-in unit. Because of its composition, this new lay-in unit can withstand exposure to flames and 2,000-degree heat. It also offers excellent acoustical and sound attenuation properties.

The second element is a new suspension system capable of withstanding the same extreme conditions as the lay-in unit. Called the Armstrong Acoustical Fire Guard Grid Suspension System,* it is designed to accommodate the expansion of both main runners and cross-tees, and thus to hold the lay-in unit securely in place when exposed to fire. The Fire Guard Grid Suspension System is the first to be combined with a lay-in ceiling unit to offer rated fire protection. Both the lay-in unit and the grid system carry the U.L. label.

Economy in time and money

In most cases, the new lay-in ceiling system will cost even less than ordinary plaster ceilings on metal lath. And like Fire Guard tile, it can save builders up to *two months'* construction time because it goes in dry. This is especially important in school construction. Schools *must* open on time. Fire Guard helps meet deadlines – at savings of thousands of dollars.

The Acoustical Fire Guard lay-in ceiling system is now available in both a Fissured and the popular Classic designs. There are two nominal sizes: 24″ x 24″ x 5/8″ and 24″ x 48″ x 5/8″.

For more information about either Acoustical Fire Guard tile or lay-in units, call your Armstrong acoustical contractor (he's in the Yellow Pages under "Acoustical Ceilings") or your nearest Armstrong District Office. Or write to Armstrong Cork Company, 4201 Park Avenue, Lancaster, Pennsylvania.

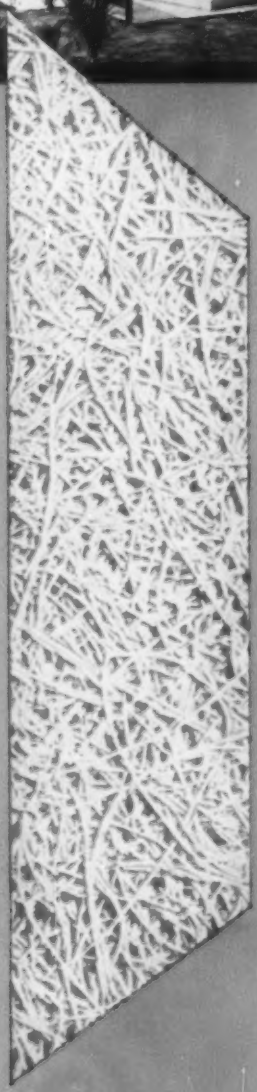
* Patent Pending

Armstrong ACOUSTICAL CEILINGS

First in fire-retardant acoustical ceilings

Architectural design and rendering by Helmut Jacoby

HOWARD JOHNSON MOTOR LODGE, PENSACOLA, FLA.
Architect: H. A. MacEwen, Miami, Fla.
Contractor: Shapiro Construction Co., Valdosta, Ga.



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CONSULTING ENGINEER
Saint Joseph, Michigan

The Master Builders, by Peter Blake; Alfred A. Knopf, New York, N. Y.; $6.50.

Le Corbusier has his chapel at Ronchamp, Mies van der Rohe his Seagram Building, and Frank Lloyd Wright his Imperial Hotel. Of these, only the last is of engineering significance, but all have left their permanent mark on architecture present and yet to come. For, according to Peter Blake, Corbu is the master of form, van der Rohe of structure, and Wright of space.

The three master builders have much in common when their office buildings, apartments, and similar structures are compared. This is not at all apparent to the layman who looks at their designs for homes. However, it is probably the city that will bring a synthesis of the various concepts of these three men. In fact, Blake believes that this will be the next phase in the evolution of modern architecture. To Corbu and Mies go the credit for supplying the basic functional and structural framework for the future city — to Wright goes the credit for giving the city life.

It is not too difficult to understand Blake's contention that Saarinen, Johnson, Rudolph, and Yamasaki are all making their own personal attempts to synthesize the concepts of the masters. However, it is a little harder for the engineer, who intuitively senses the engineering authority of Torroja, Catalano, Candela, Nervi, and Otto, to see in their work the guiding hand of Frank Lloyd Wright. But perhaps Blake is right. At any rate, consulting engineers in the building trades might well benefit from a reading of *The Master Builders*. For if they understand the ideas of these three, they can approach the engineering problems of today's architecture with greater sympathy, if not complete understanding.

•

Technology and the Academics: An Essay on Universities and the Scientific Revolution, by Sir Eric Ashby; St. Martin's Press, New York, N. Y.; $3.25.

By now, engineers are aware of the major debate taking place in their alma maters: the fundamental question of how best to educate the engineers. Many engineers will remember from their student days the controversy over the emphasis to be placed on the "humanities" in the engineering curriculum, and the argument over the degree of specialization.

In this slender volume, Sir Eric Ashby writes lucidly and penetratingly of the history and contemporary problems of scientific and technological education. President and Vice-Chancellor of the Queen's University, Belfast, Sir Eric's focus is upon British universities, but Americans will find his arguments germane.

The opening chapters describe the delayed reaction of the British universities to the Scientific Revolution of the 17th century. Oxford and Cambridge needed two cen-

turies to accept the role given science by such great Englishmen as Newton and Francis Bacon, then the English universities decided that the German universities of the 19th century should serve as models for adapting their curricula to the Scientific Revolution. The author interestingly and convincingly explains this paradox.

After surveying the history of science education in the universities, Sir Eric turns to technology. The English manufacturers were afraid of technological education (trade secrets and know-how might be disseminated) and social snobbery held that education in the applied sciences was suited only for the more gifted and industrious members of the working class. Nevertheless, British universities began to offer courses in technology in the late 19th century. Unlike the continental system, where the universities taught the liberal arts and science and the engineering schools taught technology, the British universities assumed responsibility for all three courses of study.

Readers familiar with the history of engineering education in the United States will note the many parallels between events here and across the Atlantic, and the similarity will not end as Sir Eric discusses contemporary aspects of his subject. The most exciting and difficult problem facing the institutions of higher learning today is aligning with and adjusting to "the currents of thought flowing from the second industrial revolution."

The author's solution is tailored primarily for the engineering student (it is possible to read the author as implying that all higher education will be primarily technologically-centered). He envisages the student concentrating on a limited engineering or technological field ("the *sine qua non* for a man who desires to be cultured is a deep and enduring enthusiasm to do one thing excellently."). The student's specialist studies would then become the core for his liberal studies. As an example, the author cites the specialist in brewing who would also study biology, micrology, chemistry, economics of marketing beer, public houses (in their design, in architecture), the history of beer-drinking, and the unhappy effects of drinking too much beer.

In a further elaboration of his plan, the author lists the following courses which might be taken by the engineer: ethics and jurisprudence; industrial and social history (especially the social effects of technological change); political theory and institutions; industrial psychology; sociology and social anthropology; the history of technology; and linguistics and communication.

This curriculum differs essentially from that offered or proposed in many U. S. engineering universities in that it does not hold out a smattering of art, architecture, history, or literature for the engineer as a liberating course of study. The engineer is not urged to adorn the structure of his technical education with the frills of culture. Sir Eric is recommending that the engineer see his profession in the round – to integrate it into the culture. Sir Eric's engineer with a truly liberal education will not design and build his bridge in the abstract during the work day and pursue his "culture" as an escape in the evenings, but will design and build a bridge taking into account all the social, political, and cultural factors involved. As the author notes, an engineering work in an underdeveloped region is frequently a major experiment in social anthropology.

The engineer may object to the author's proposal on the ground that the engineer is not in a position to make decisions of social and political significance in connection with his engineering work, an objection less valid for the consulting engineer than for the salaried engineer. It may well be time to

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consider the question whether the engineer should not take increased responsibility for the impact of his work upon society – if so, then Sir Eric Ashby's proposal for a reform in technological education is of vital interest.

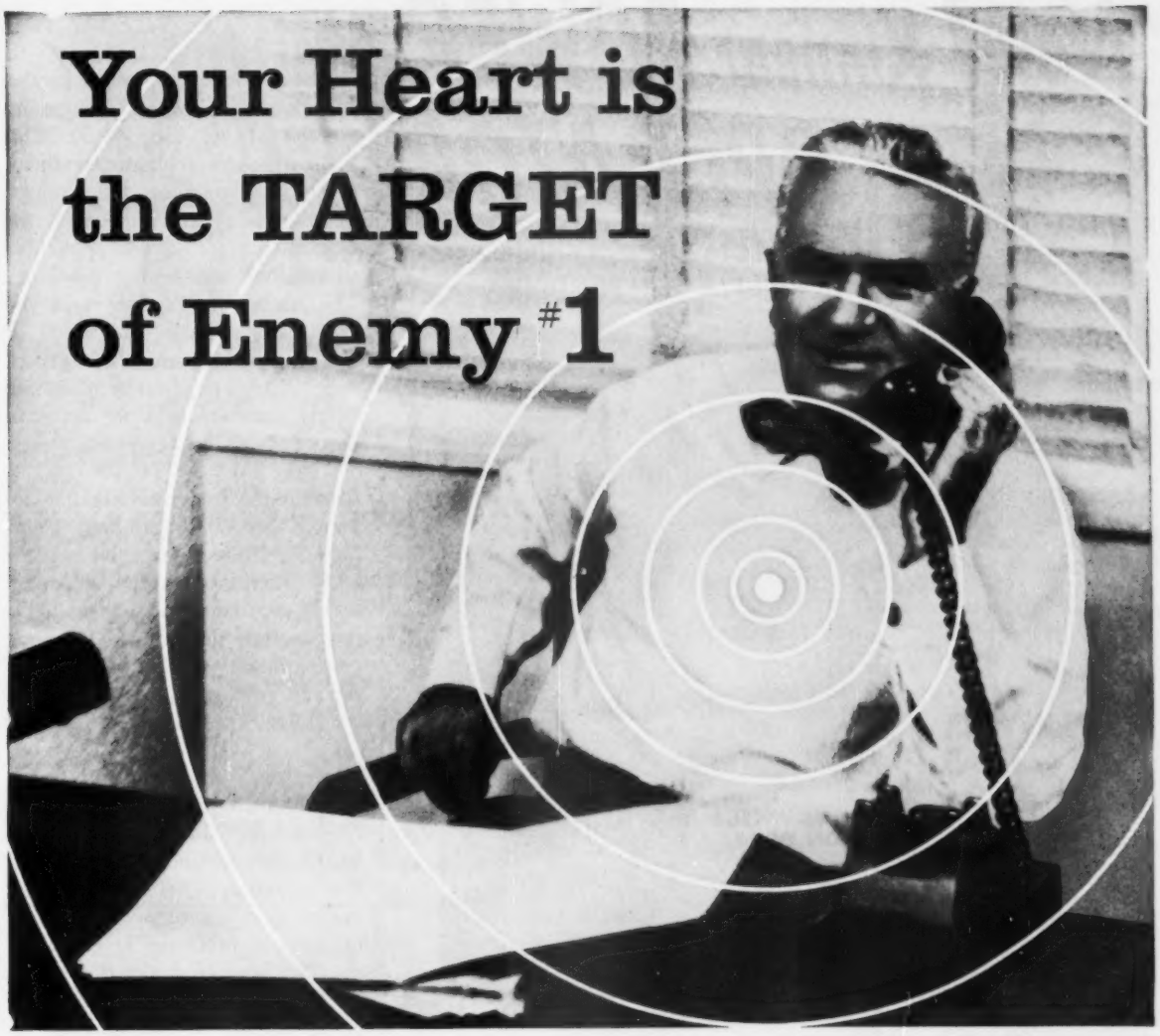
One thing is certain – it would be naive of the engineer to assume that the politician who makes the key decisions affecting the initiation of engineering works has an education that explains the role of science and engineering in society.

•

Technical Writing Techniques for Engineers, by Joseph Racker; Prentice-Hall, Inc., Englewood Cliffs, N. J.; $6.95.

It is probably safe to say that most of today's technical writers are either employed directly by government or by industries working for the government. Under these circumstances, their product is primarily technical manuals – thousands upon thousands of them. Thus, many of the books being published on the subject of technical writing are overly concerned with technical manuals and the terminology used in highly specialized fields of military engineering.

Considering these facts, it is not surprising to find that over 100 of the 234 pages of this book are devoted to glossaries of military terminology. As a matter of fact, the author does little more than to define five levels of technical writing, ranging from the operator's or nontechnical level on up to the advanced engineer's or scientific level. These levels of writing are amply illustrated with typical examples. In addition to this chapter there is one dealing with the use of the right word and one on the use of technical illustrations. A final chapter discusses the preparation of technical manuscripts. It is doubtful that the engineer who wants to write better can learn anything from this book other than how to arrange the material which he wants to present.



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New Technical Books

APPLIED MECHANICS FOR ENGINEERS, by James Grassie; Longmans, Green & Co., Inc.; $9.50. This book, through separate treatment of statics, dynamics, and strength of materials, tries to cover the fundamental principles applicable to unusual engineering problems. The author is English, and the book is geared to the needs of British student engineers, but there seem to be none of the troublesome British standard to American standard conversions involved.

CERMETS, edited by J. R. Tinklepaugh and W. B. Crandall; Reinhold Publishing Corp., New York; $9.50. This is a collection of papers by 23 experts in the field of high-temperature materials. The book covers fundamental aspects, forming and processing, testing, and applications of cermets.

ENGINEERING MECHANICS, by Irving H. Shames; Prentice-Hall, Inc., Englewood Cliffs, New Jersey; $9.75. This combined volume includes statics, dynamics, and kinematics in a practical approach to mechanical problems in engineering. The book requires no previous knowledge of vector algebra or vector calculus; these topics are introduced and explained in the text.

CONSTRUCTION CONTRACTING, by Richard H. Clough; John Wiley & Sons, Inc., New York; $9.75. This book discusses the problems of management in the construction industry, explaining the complicated inter-relationships among organizing staffing, directing, planning, and controlling functions in a contracting firm. There are also valuable references to insurance, contract bonds, and labor legislation.

INDUSTRIAL ARCHITECTURE, by James Munce; F. W. Dodge Corp., New York; $14.75. This large, well-illustrated book is an analysis of basic principles and current trends

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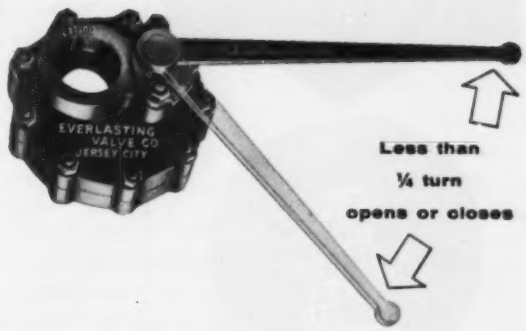

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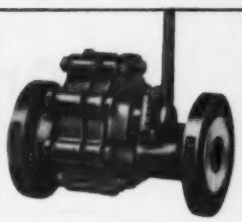

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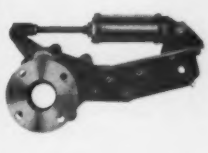

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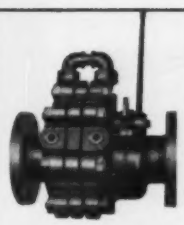

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in factory design in the United States, Great Britain, and Europe. The author emphasizes changing trends, and the importance of planning for the future.

TABLES FOR COMBINED BENDING AND AXIAL LOAD ON REINFORCED CONCRETE COLUMNS; Saby Eliachar, Civil Engineer, 15 Rockford Avenue, Daly City, California; $25.00. This book is a copy of the output tape of an IBM 704 Computer, treating the design of reinforced concrete columns by cracked sections. The tables range from 12 to 30 inch columns, and are figured for 3000 psi concrete. Sample tables may be obtained by writing to the author.

PRINCIPLES OF CONTROL SYSTEMS ENGINEERING, by Vincent Del Toro and Sydney R. Parker; McGraw-Hill Book Co., New York; $14.50. This advanced text deals with feedback control systems, presenting the chronological development of each of the fundamental phases of control systems engineering. Major topics are mathematical background; the time-domain approach; the frequency-domain approach; the root locus approach; and the computer approach. There is also a section on self-adaptive systems as well as rather extensive appendices.

THE MECHANICS OF VIBRATION, by R. E. D. Bishop and D. C. Johnson; Cambridge University Press, New York; $19.50. Both the scope and the price of this book seem to designate it as a reference work rather than a text. The authors, professors of mechanical engineering in England, start with the concept of steady forced motion, then introduce free motion as a limiting case. The aim of the book is to explain the nature of vibration characteristics, not to provide a recipe for formal calculation. The mathematics involved, according to the dust jacket, ". . . will be understood by

the question is time

During the past few years, the cancer cure rate has increased from one in four saved to one in three saved: 40,000 more lives saved each year. During the next few years, there will no doubt be new methods of diagnosis, and even cures for some cancers that are considered incurable today. In time, the ultimate goal, cancer prevention, will be achieved. But time alone will not do the job. ● Time plus research will. Research costs money. In the past 14 years, the American Cancer Society has spent about $76,500,000 on cancer research. Much more is needed to accomplish the final conquest of this dread disease. Give generously. Send your contribution to "Cancer," in care of your local post office.

AMERICAN CANCER SOCIETY

the answer is money

guard your family...fight cancer with a checkup and a check

a student taking an honours course in engineering."

PRECISION MEASUREMENT AND GAGING TECHNIQUES, by William Grohe; Chemical Publishing Co., New York; $7.50. The general acceptance of quality control has heightened the necessity for precision measurement. The author of this book tries to make up for what he feels is a failure of the schools to include training in precise measuring and gaging as part of the engineering curriculum. The book covers methods of precision measurement and factors which influence it.

COMPUTER LOGIC, by Ivan Flores; Prentice-Hall, Englewood Cliffs, New Jersey; $12.00. Subtitled *The Functional Design of Digital Computers*, Dr. Flores's book explains and illustrates exactly how a computer is put together and how it works. The author dispenses with much of the advanced mathematics usually found in such writing, preferring to discuss the relationships of fundamental units in terms of operational necessity. The book includes a detailed review of the entire process, from the introduction of information to the completion of the answer; as well as a glossary.

QUANTUM THEORY OF ATOMIC STRUCTURE (2 volumes), by John Slater; McGraw-Hill, New York; $11 (vol I) and $13 (vol II). Professor Slater, Institute Professor at MIT, plans this impressive two-volume work as only the beginning of a series of books covering the field of application of quantum mechanics to the structure of atoms, molecules, and solids. The physical and chemical properties of matter will also be discussed in the series. These first two books start with the beginning of the quantum theory, and progress through to the status of present-day research. The first volume is of an elementary nature, suited for use as a text on quantum theory; the second volume is more advanced. ▲▲

SOME PLAIN FACTS

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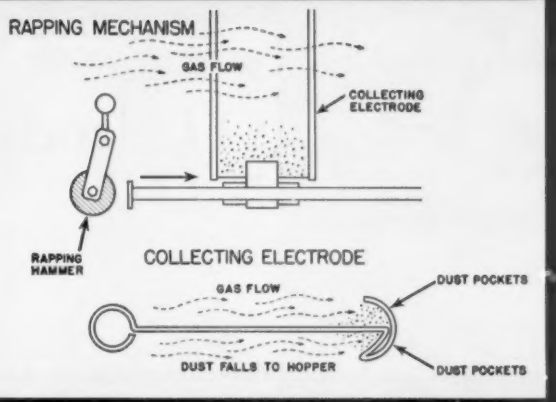
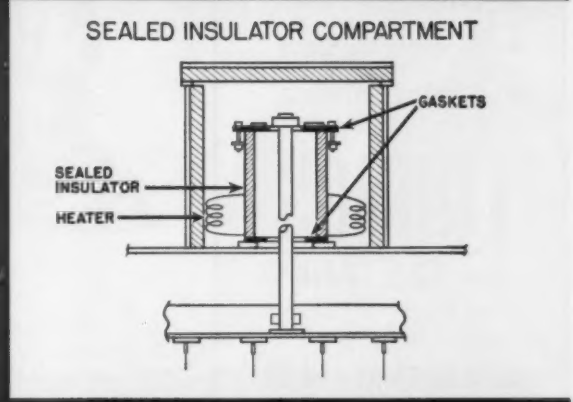
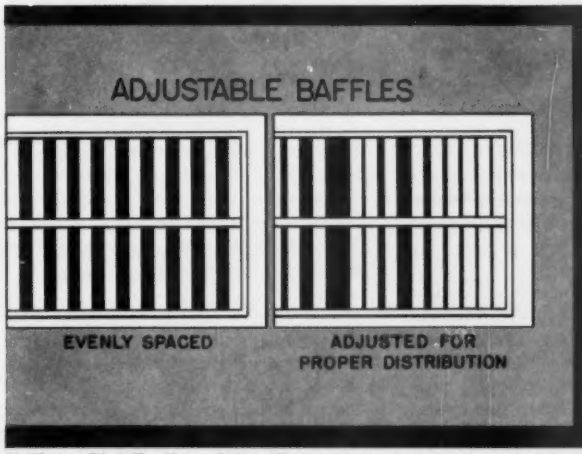
Buell Precipitators are designed and constructed for rugged service and superior performance. Frills and internal frim-fram of a doubtful value are eliminated in favor of strength and simplicity. The casing, outside supports, and internal parts are of rugged construction; and the four-point suspension of emitting electrodes ensures the greatest stability. Here are just a few of the outstanding features of Buell Precipitators.





Effective Continuous Cycle Rapping—Yes, it's mechanical. A simple, rugged system free of complicated gadgets; assures positive dust shearing action. Each row of electrodes is rapped separately—in the direction of the gas flow—on a continuous cycle. Dust is sheared off, drops in an agglomerated mass and pockets on electrodes minimize reentrainment.

Sealed Insulators Improves Operation—High voltage quartz support insulators are completely sealed; prevents gas and dust leaking into insulator compartment and outside air leaking into precipitator. There is no need for costly ventilating systems. Thermostatically controlled electric heaters insure start-up without danger of moisture condensation and insulator breakdown.



Uniform Distribution of Gas Flow—Field adjustment capability is vital. Buell's adjustable baffle permits final positioning after field measurement of actual flow distribution . . . because gas flow patterns are not entirely predictable. The Buell distribution system assures equal gas loading through the precipitator; eliminates ineffective "dead" areas around passages and prevents "sneak-by."

Buell Spiralectrodes cut maintenance to a minimum. Buell's record stands at less than 1% replacement in this key area. Self-tensioned spiralectrodes eliminate vibration and "off-center" swaying, often prevalent with weight-tensioned wires. They're structurally fixed and once installed stay in alignment. The spiralectrode provides greater emission than straight wires.

Buell precipitators are simple and effective. They're designed for continuous service. You'll be glad you turned to Buell when you experience superior performance and low maintenance. Detailed literature describing all features is available.

buell Norblo

The Buell Engineering Co., Inc., Dept. 47-A, 123 William Street, New York 38, N. Y. Northern Blower Division, 6426 Barberton Avenue., Cleveland, Ohio. ■Electric Precipitators ■Cyclones ■Bag Collectors ■Combination Systems ■Fans ■Classifiers.

Consulting Engineers' Calendar

Jan. 16-18. The Pennsylvania State University; Conference for Land and Construction Surveyors, Campus, University Park, Pennsylvania.

Jan. 16-19. Instrument Society of America; Winter Instrument-Automation Conference & Exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis, Missouri.

Jan. 18-20. American Road Builders' Association; Annual Convention, Cincinnati, Ohio.

Jan. 19. Engineers Joint Council; Annual Board Meeting, Biltmore Hotel, New York.

Jan. 23-Feb. 3. Cornell University; Short Course in Photointerpretation and Photogrammetry, Campus, Ithaca, New York.

Jan. 23-Feb. 3. University of California; 1961 Engineering and Management Course, Campus, Los Angeles, California.

Feb. 9-11. National Society of Professional Engineers; Winter Meeting, Hotel Fort Des Moines, Des Moines, Iowa.

Feb. 13-16. American Society of Heating, Refrigerating & Air-Conditioning Engineers; 15th International Heating, Refrigeration & Air-Conditioning Exposition, International Amphitheatre, Chicago, Illinois.

Feb. 19-23. American Society of Civil Engineers; Regional Convention, Texas A & M College, Houston, Texas.

Feb. 20-23. American Concrete Institute; 57th Annual Convention, Chase-Park Plaza Hotels, St. Louis, Missouri.

Feb. 26-March 1. American Institute of Chemical Engineers, National meeting, Roosevelt Hotel, New Orleans, Louisiana.

Feb. 26-March 2. American Institute of Mining Engineers; Annual Meeting, the Chase-Park Plaza Hotel and the Ambassador Hotel, St. Louis, Missouri.

March 5-8. Third National Lighting Exposition and World Lighting Forum, New York City Coliseum, New York.

March 5-8. American Road Builders' Association; Annual Convention, Haddon Hall, Atlantic City, N.J.

March 5-9. American Society of Mechanical Engineers; Gas Turbine Power Conference & Exhibit (co-sponsored by U. S. Department of Defense), Shoreham Hotel, Washington, D. C.

March 16-17. University of Arizona; Conference on Data Processing Problems, Campus, Tucson, Arizona.

April 5-7. American Institute of Electrical Engineers; Southeast Meeting, New Orleans, La.

April 9-13. American Society of Mechanical Engineers; Oil & Gas Power Conference & Exhibit, Jung Hotel, New Orleans, La.

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Recommended for:

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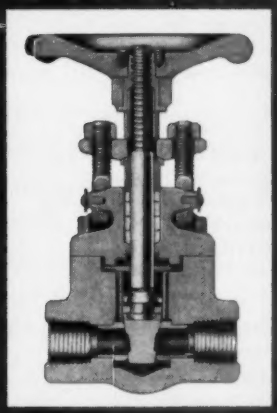

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Other new design features like these add up to a long life of trouble-free service:

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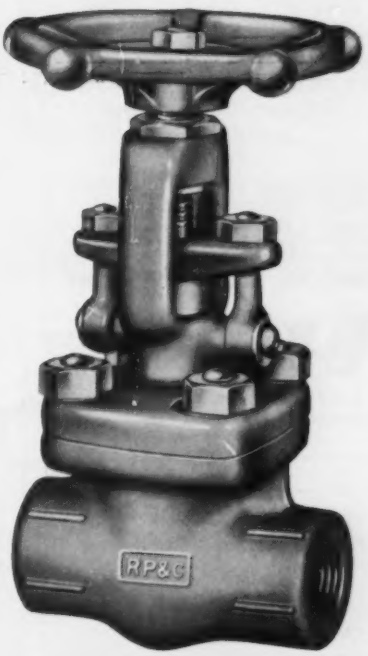

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ADVERTISERS' INDEX

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Because NAYLOR pipe is light in weight, it is easier to handle and install. Moreover, the distinctive lockseamed-spiralwelded structure provides the strength and safety your job requires.

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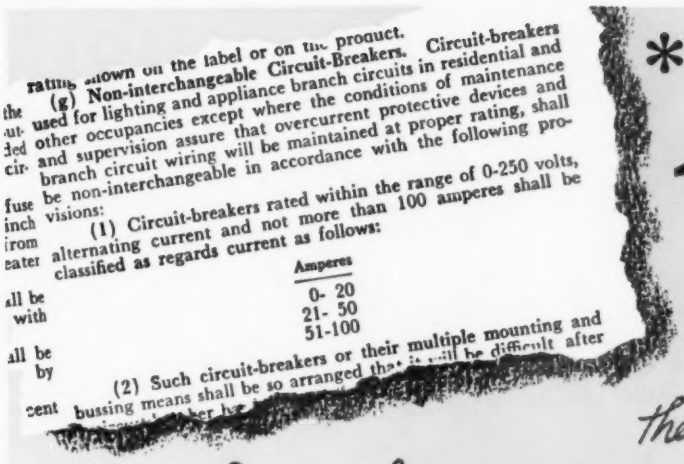


ratings shown on the label or on the product.

(g) Non-interchangeable Circuit-Breakers. Circuit-breakers used for lighting and appliance branch circuits in residential and other occupancies except where the conditions of maintenance and supervision assure that overcurrent protective devices and branch circuit wiring will be maintained at proper rating, shall be non-interchangeable in accordance with the following provisions:

(1) Circuit-breakers rated within the range of 0-250 volts, alternating current and not more than 100 amperes shall be classified as regards current as follows:

Amperes
0- 20
21- 50
51-100

(2) Such circuit-breakers or their multiple mounting and bussing means shall be so arranged that it will be difficult after

*

In many installations today there's a big question...

Does this code requirement apply Or doesn't it?

NO GUESSWORK WITH SQUARE D PANELBOARDS AND LOAD CENTERS

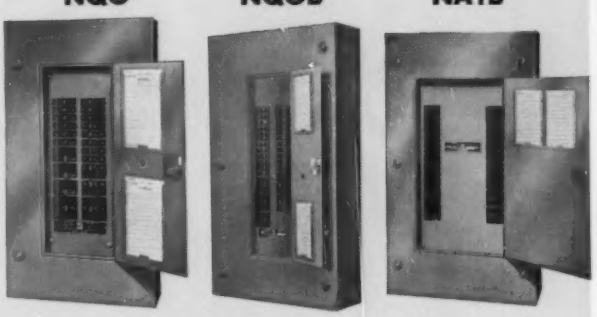
✓ **Exclusive Non-Interchangeable Construction Standard on all 250 Volt, 100 Amp Branch Circuit Breaker Panelboards and Load Centers!**

✓ **No delays, extra labor and tied-up money because of disapprovals!**

Square D's simple yet effective system provides non-interchangeability on panelboards and load centers without added cost of installation complications. It complies fully with Article 240-25(g) of the NEC.* There are no loose parts to change, remove or lose. What's more, being a completely visible system, a quick glance settles any question of compliance.

When adding circuits, there are no modifications required for 15 or 20 ampere breakers—80% of all branches. Only one simple operation for the remaining 20%. Errors can be corrected—quickly and simply. No guesswork—*ever.*

Another example of the design leadership that has made Square D the world's leading manufacturer of panelboards and load centers. Write for complete story—address Square D Company, Mercer Road, Lexington, Kentucky.



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ONE UL APPROVED NON-INTERCHANGEABLE SYSTEM FOR ALL 3 LINES—FOR LOAD CENTERS, TOO!

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Where perimeter heat is indicated, *Nesbitt Sill-line Radiation* is your prescription. The five Sill-line accessories shown here illustrate but one way this product has been designed to provide a better solution to most installation conditions. There are many others: the five enclosure styles; the six decorator colors; the one-piece back panel that permits mullion-to-mullion application on panel walls. All point up the versatility of *Nesbitt Sill-line Radiation.*
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